



Charter School Performance in Pennsylvania **2019**

© 2019 CREDO

**Center for Research on Education Outcomes
Stanford University
Stanford, CA**

<https://credo.stanford.edu/>

CREDO, the Center for Research on Education Outcomes at Stanford University, was established to improve empirical evidence about education reform and student performance at the primary and secondary levels. CREDO at Stanford University supports education organizations and policymakers in using reliable research and program evaluation to assess the performance of education initiatives. CREDO's valuable insight helps educators and policymakers strengthen their focus on the results from innovative programs, curricula, policies and accountability practices.

Acknowledgements

CREDO gratefully acknowledges the support of the Pennsylvania Department of Education, which contributed its data to this partnership. Our data access partnerships form the foundation of CREDO's work, without which studies like this would be impossible. We strive daily to justify the confidence you have placed in us.

Disclaimers

The views expressed herein do not necessarily represent the positions or policies of the organizations noted above. No official endorsement of any product, commodity, service, or enterprise mentioned in this publication is intended or should be inferred. The analysis and conclusions contained herein are exclusively those of the authors and are not endorsed by any of CREDO's supporting organizations, their governing boards, or the state governments, state education departments or school districts that participated in this study.

Table of Contents

1.	Introduction	1
2.	Study Approach	3
3.	Pennsylvania Charter School Demographics	6
4.	Analytic Findings of Charter School Impacts.....	10
	Overall Charter School Impact.....	10
	Charter School Impact for the 2014-2017 Cohort	12
	Charter School Impact by Growth Period.....	13
5.	Charter School Analysis by School Attribute.....	14
	Charter School Impact by School Locale.....	14
	Charter School Impact by School Grade Configuration.....	15
6.	Charter School Analysis by Student Characteristic.....	17
	Charter School Impact by Race/Ethnicity	17
	Charter School Impact with Students in Poverty.....	21
	Charter School Impact with Combined Race/Ethnicity and Poverty	23
	Charter School Impact with Special Education Students.....	27
	Charter School Impact with English Language Learners.....	29
	Charter School Impact by Students' Years of Enrollment	32
7.	School-level Analysis	33
	Comparative School-Level Quality	33
	Growth and Achievement.....	35
8.	Analysis of Online Charter Schools	38
	Overall Charter Impact by Delivery System.....	38
	Online Charter School Impact for the 2014-2017 Cohort.....	41
9.	Synthesis and Conclusions.....	43
	Summary of Major Findings	43
	Implications	46
	Appendix A. Number of Observations for All Results	47
	Appendix B. Technical Appendix	48
	Demographic Composition of Charter Students in the Study	48
	Comparison of Starting Scores of Matched Students and VCRs.....	50
	Measuring Academic Growth	52
	Models for Analysis of the Charter School Impact	52
	Presentation of Results	53

Table of Figures

Figure 1: CREDO Virtual Control Record Methodology	4
Figure 2: Opened, Continuing, and Closed Charter Campuses, 2013-14 to 2016-17	6
Figure 3: Average Learning Gains in Pennsylvania Charter Schools Compared to Average Gains for TPS VCRs.....	11
Figure 4: Average Learning Gains in Pennsylvania Charter Schools Compared to Average Gains for TPS VCRs from the 2013 National Charter Study and 2019 Pennsylvania Study	12
Figure 5: Learning Gains in Pennsylvania Charter Schools Compared to Gains for TPS VCRs by Growth Period: 2014-2015 to 2016-2017	13
Figure 6: Learning Gains in Pennsylvania Charter Schools Compared to Gains for TPS VCRs by School Locale	15
Figure 7: Learning Gains in Pennsylvania Charter Schools Compared to Gains for TPS VCRs by School Grade Configuration	16
Figure 8: Learning Gains of Black Students in TPS and Charters Benchmarked against Learning Gains of White TPS Students	18
Figure 8a: Relative Learning Gains for Black Charter School Students Benchmarked against Their Black TPS Peers.....	19
Figure 9: Learning Gains of Hispanic Students in TPS and Charters Benchmarked against Learning Gains of White TPS Students	20
Figure 9a: Relative Learning Gains for Hispanic Charter School Students Benchmarked against Their Hispanic TPS Peers	21
Figure 10: Overall Learning Gains for TPS and Charter Students in Poverty Compared to TPS Students Not in Poverty	22
Figure 10a: Relative Learning Gains for Charter School Students in Poverty Benchmarked against Their TPS Peers in Poverty	23
Figure 11: Learning Gains of Black TPS and Charter Students in Poverty Compared to Learning Gains of White TPS Students Not in Poverty	24
Figure 11a: Relative Learning Gains for Black Charter School Students in Poverty Benchmarked against Their Black TPS Peers in Poverty	25
Figure 12: Learning Gains of Hispanic TPS and Charter Students in Poverty Compared to Learning Gains of White TPS Students Not in Poverty.....	26
Figure 12a: Relative Learning Gains for Hispanic Charter School Students in Poverty Benchmarked against Their Hispanic TPS Peers in Poverty	27
Figure 13: Learning Gains for TPS and Charter Students in Special Education Compared to TPS Students Not in Special Education	28
Figure 13a: Relative Learning Gains for Charter Students in Special Education Benchmarked against Their TPS Peers in Special Education	29
Figure 14: Learning Gains for TPS and Charter ELL Students Compared to TPS Non-ELL Students.....	30
Figure 14a: Relative Learning Gains for Charter ELL Students Benchmarked against Their TPS ELL Peers	31

Figure 15: Learning Gains of Charter Students Compared to Gains for Average TPS VCRs by Students' Years of Enrollment in Charter Schools	32
Figure 16: Student Learning Gains for Students in Pennsylvania Online and Brick-and-Mortar Charter Schools Benchmarked against Learning Gains for Average TPS VCRs.....	39
Figure 16a: Student Learning Gains in Pennsylvania Online Charter Schools Benchmarked against Students in Pennsylvania Brick-and-Mortar Charter Schools	40
Figure 17: Average Learning Gains in Pennsylvania Online Charter Schools Compared to Average Gains for TPS VCRs from the 2015 Online Study and 2019 Pennsylvania Study	41
Appendix Figure 1: Comparison of Starting Reading Scores of Matched Charter Students and VCRs... Appendix Figure 2: Comparison of Starting Math Scores of Matched Charter Students and VCRs	51

Table of Tables

Table 1: Demographic Comparison of Students in TPS, Feeders, and Charters: 2015-16	8
Table 2: Demographic Composition of Overall, Brick-and-Mortar, and Online Charter Schools: 2015-16	9
Table 1: Transformation of Average Learning Gains to Days of Learning.....	11
Table 4: Charter School Impacts on Student Subgroup Learning Gains	31
Table 5: Performance of Charter Schools Compared to Their TPS Alternatives in Pennsylvania	34
Table 6: School-Level Reading Growth and Achievement in Pennsylvania Charter Schools	36
Table 7: School-Level Math Growth and Achievement in Pennsylvania Charter Schools	37
Table 8: Learning Gains of Online and Brick-and-Mortar Charter School Student Subgroups Compared to Gains of TPS VCRs in the Same Subgroup	42
Table 9: Summary of Analysis Findings for Pennsylvania Charter School Students Benchmarked against Comparable TPS Students	43
Appendix Table 1: Number of Observations for All Results.....	47
Appendix Table 2: Demographic Composition of Charter Students in the Study: Period 1	49
Appendix Table 3: Demographic Composition of Charter Students in the Study: Period 2	49
Appendix Table 4: Demographic Composition of Charter Students in the Study: Period 3	49

List of Acronyms & Definitions

CREDO	Center for Research on Education Outcomes
ELLs	English Language Learners
EOC	End-of-Course Exam
TPS	Traditional Public School
VCR	Virtual Control Record
NAEP	National Assessment of Educational Progress
NCES	National Center for Education Statistics
Feeder	A feeder school is a traditional public school whose students have transferred to a given charter school. We use students attending feeder schools as potential matches for students attending charter schools.
Growth	The year-to-year change in academic performance relative to one's peers. Growth can be positive or negative.

Charter School Performance in Pennsylvania 2019

1. Introduction

In an evolving public education landscape, charter school education reaches an increasing number of students each year. While the expansion of charter schools is evident, questions about their efficacy persist. Active debate has occurred in Pennsylvania continuously since the passage of the law authorizing charter schools in 1997. Charter school advocates hail the benefits of the sector such as increasing parental choices and introducing new school models. Opponents decry the reallocation of funds away from district schools as an existential threat to district organizations and the mismatch between district and charter student profiles as evidence of charters' neglecting hard-to-serve students. Only a fraction of that debate is grounded in well-researched evidence about charter schools, their practices, and their impact on student outcomes.

The need for evidence about charter school performance is especially strong in Pennsylvania. The charter school law in Pennsylvania has remained largely unchanged since its passage in 1997. There were minor amendments to the law, including the amendment to authorize cyber charter schools in 2002.¹ Since the amendment authorizing cyber charter schools, there have been many efforts to enforce existing regulations of charter schools to hold all charters accountable. Efforts to strengthen the regulatory environment for charter schools have been rebuffed, but the debate around accountability of charter schools in Pennsylvania continues.

According to the Center for Rural Pennsylvania, charter school enrollment has grown dramatically since the mid-2000s, with noteworthy expansion in both urban and rural areas. In addition, Pennsylvania experienced a 75 percent increase in online charter school enrollment between 2006-2007 and 2010-2011.² Currently one quarter of Pennsylvania's charter school students enroll in online charter schools. These trends motivate the current study.

This report provides evidence for the effect of charter schools on students' performance in Pennsylvania over four years of schooling, beginning with the 2013-2014 school year and ending with

¹ Charter School Law, Pennsylvania General Assembly, 1949 Act 14 (1997).

² Schafft, K., Frankenberg, E., Fuller, Ed., Hartman, W., Kotok, S., Mann, B., Penn State University, Department of Education Policy Studies. Assessing the Enrollment Trends and Financial Impact of Charter Schools on Rural and Non-Rural School Districts in Pennsylvania (2014).

http://www.rural.palegislature.us/documents/reports/Charter_School_2014.pdf.

the 2016-2017 school year. This is an update to an earlier study released in 2011.³ The 2011 study found across all charter schools, student academic progress in reading and math lagged behind identical peers in traditional public schools (TPS). The 2011 findings also showed wide variation in student and school performance, with a quarter of charter schools outperforming their local school options in reading and over half outpacing their local TPS in math. Of particular note, the 2011 study was the first time the differences in student academic progress for online charter schools and brick-and-mortar charter schools were compared; online charter schools posted significantly smaller learning gains than were seen in other charter schools.⁴ This study updates the earlier analyses with contemporary data.

With cooperation from the Pennsylvania Department of Education (PDOE), CREDO obtained historical sets of student-level administrative records. The support of PDOE staff was critical to CREDO's understanding of the character and quality of the data we received. However, it is important to note that those interactions with the department dealt only with technical issues related to the data. CREDO has developed the findings and conclusions presented here independently.

In this report, we present the results from three sets of analysis. We first present findings regarding the effects of charter schools on student academic performance for the period 2013-2014 to 2016-2017. These results are expressed in terms of the academic progress that a typical charter school student in Pennsylvania would realize from a year of enrollment in a charter school. To help the non-technical reader grasp the findings, we translate the scientific estimates into estimated days of learning based on the foundation of a 180-day school year.

The second set of analysis looks at the performance of students by school and presents school average results. These findings are important to understand the range of performance at the school level.

The third set of analysis illustrates the impact of online charter schools in Pennsylvania, also referred to as cyber charter schools. Students attending online charter schools represent a quarter of all students attending charter schools in Pennsylvania. Online charter schools serve students with different characteristics and deliver curriculum differently than brick-and-mortar charter schools. Our analysis focuses on charter schools that provide full-time online education and excludes programs that incorporate online instruction as a portion of a blended educational model.

The analysis shows that in a year's time, the typical charter school student in Pennsylvania makes similar progress in reading and weaker growth in math compared to the educational gains that the students would have had in a traditional public school (TPS). Thinking of a 180-day school year as "one year of learning", an average Pennsylvania charter student experiences weaker annual growth in math equivalent to 30 fewer days of learning. Our online charter school analysis reveals that attending an

³ Charter School Performance in Pennsylvania, CREDO (Center for Research on Education Outcomes), Stanford University, April 6, 2011, http://credo.stanford.edu/reports/PA%20State%20Report_20110404_FINAL.pdf

⁴ Student academic progress is the change in a student's academic achievement from one year to the next. We also refer to this change in knowledge as "gains" or "growth", not to be confused with the Pennsylvania value-added model of student performance.

online charter school leads to substantially negative learning gains in both reading and math, which negatively affect the overall charter impact on student progress.

2. Study Approach

This study of charter schools in Pennsylvania focuses on the academic progress (growth) of enrolled and tested students in Pennsylvania's charter schools. Whatever else charter schools may provide their students, their contributions to students' readiness for secondary education, high school graduation, and post-secondary life remain of paramount importance. Furthermore, current data limitations prevent the inclusion of non-academic outcomes in this analysis.

To study academic performance of charter students in Pennsylvania, we relied on scores students received on Pennsylvania state standardized achievement tests. Achievement tests capture what a student knows at a point in time. These test results were fitted into a bell curve format enabling us to see how students moved from year to year in terms of academic performance. Two successive test scores allow us to see how much progress a student makes over a one-year period; this is also known as a growth score or learning gain. Growth scores allow us to zero in on the contributions of schools separately from other things that affect point-in-time scores. The parsed effect of schools in turn gives us the chance to see how students' academic progress changes as the conditions of their education transform. This is the analytic foundation for our examination of the academic impact of enrollment in charter schools.

We employ the Virtual Control Record (VCR) method developed by CREDO in our analysis.⁵ We strive to build a VCR for each charter school student. A VCR, or a "virtual twin", is a synthesis of the actual academic experiences of up to seven students who share identical characteristics to the charter school student, except for the fact that the VCR students attend a TPS that each charter school's students would have attended if not enrolled in the charter school. This synthesized record is then used as the counterfactual condition to the charter school student's performance.

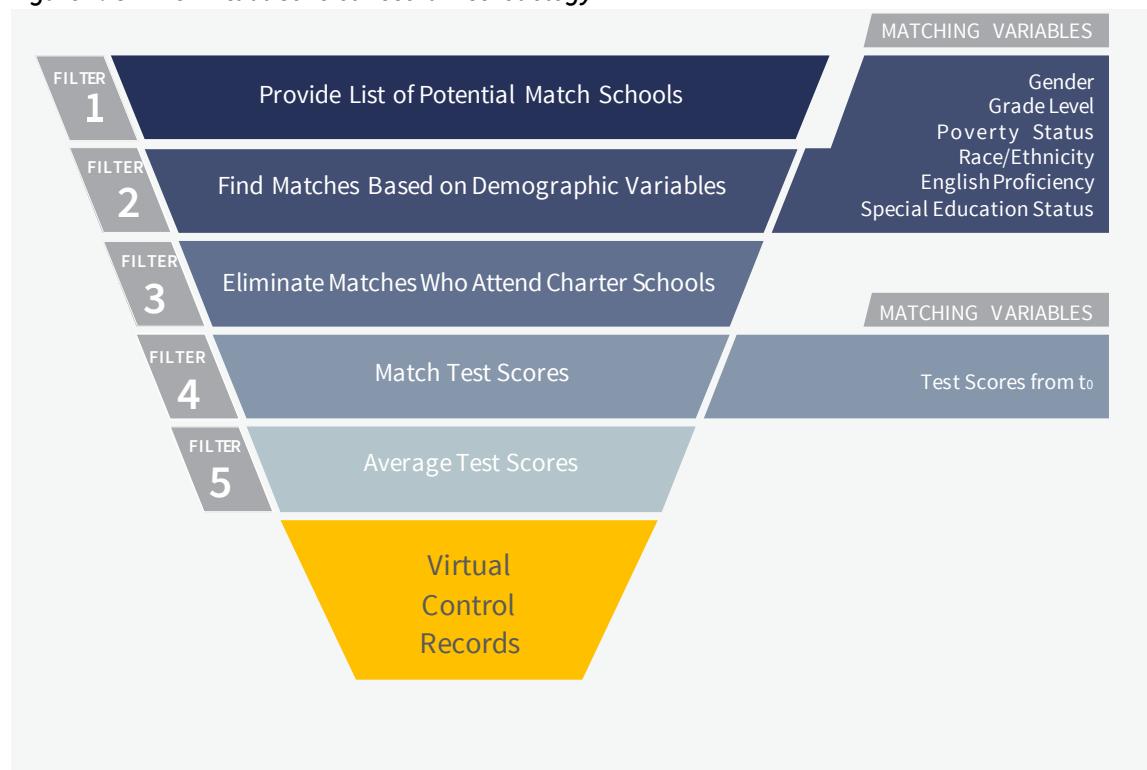
⁵ Davis, D. H., & Raymond, M. E. (2012). Choices for studying choice: Assessing charter school effectiveness using two quasi-experimental methods. *Economics of Education Review*, 31(2), 225–236.

Our approach is displayed in Figure 1. We identify all the traditional public schools whose students transfer to a given charter school; each of these schools is designated as a “feeder school.” Using the records of the students in those schools in the year prior to the test year of interest (t_0), CREDO selects all of the available TPS students who match each charter school student.

Match factors include:

- Grade level
- Gender
- Race/Ethnicity
- Poverty Status
- English Language Learner Status
- Special Education Status
- Prior test score on Pennsylvania state achievement tests

Figure 1: CREDO Virtual Control Record Methodology



At the point of selection as a VCR-eligible TPS student, all candidates and the individual charter school student have identical traits and matching baseline test scores. The focus then moves to the subsequent year, t_1 . The scores from this test year of interest (t_1) for as many as seven VCR-eligible TPS students are then averaged and a Virtual Control Record is produced. The VCR produces a score for the test year of interest that corresponds to the expected result a charter student would have realized had he or she attended one of the traditional public schools.

The above VCR method has been used in previous CREDO publications. We make two changes to the approach in this study. First, in our previous reports, if a charter student can be tracked for multiple periods in the study window, we matched the student for all the periods using the records in the year prior to the first growth period. In this study, we match the student period by period to conform to the new baseline equivalence criteria specified in *Procedures Handbook Version 4.0* of What Works Clearinghouse (WWC).⁶ Altering the match in this way means that caution is advised when comparing findings in this study and previous reports. Second, the United States Department of Agriculture phased in the Community Eligibility Provision (CEP) in Pennsylvania and other states during the study period. The CEP allows schools and local education agencies with a minimum Identified Student Percentage (40 percent or higher) to provide free breakfast and lunch to all students. To minimize over-identification of students living in poverty in the analysis, we drop from the list of feeder schools a very small number of TPS if their share of the students identified as economically disadvantaged by the state was 100 percent *and* represented a jump by 35 percentage points or more from the previous year. As Appendix Table 2 shows, restricting the feeder list did not affect the percentage of charter students for whom a VCR match was possible. It was possible to create virtual matches for 84 percent of observations of tested charter school students in both reading and math.

Using statistical methods, we isolate the contributions of schools from other social or programmatic influences on a student's growth. Student growth data are analyzed in standard deviation units so that the results can be assessed for statistical differences. All the findings that follow are reported as the **average one-year growth** of charter school students relative to their VCR-based comparisons. With four years of student records in this study, it is possible to create three periods of academic growth.

To assist the reader in interpreting the meaning of growth, we include an estimate of the number of days of learning required to achieve growth of particular units of standard deviations. This estimate was calculated by Dr. Eric Hanushek and Dr. Margaret Raymond based on the 2017 National Assessment of Educational Progress (NAEP) test scores.⁷ Using a standard 180-day school year, each one standard deviation (s.d.) change in effect size is equivalent to 590 days of learning.

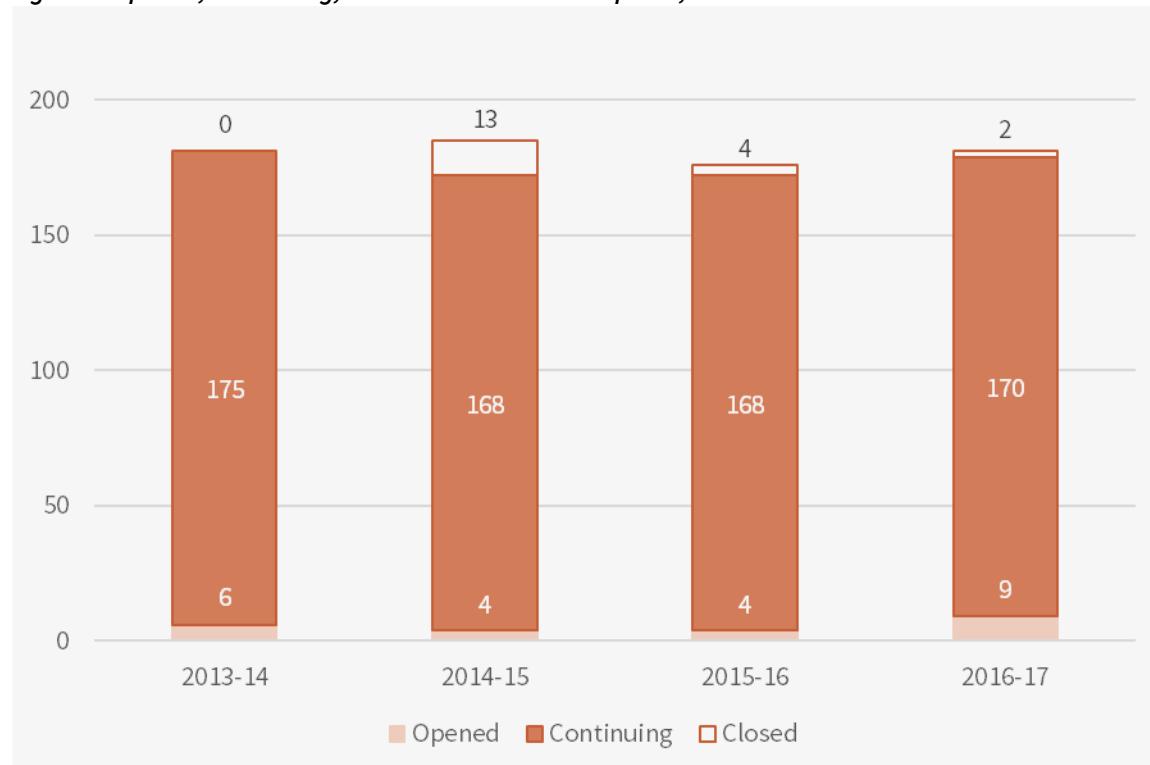
⁶ What Works Clearinghouse (2017). Procedures Handbook Version 4.0.
https://ies.ed.gov/ncee/wwc/Docs/referenceresources/wwc_procedures_handbook_v4.pdf.

⁷ Detailed information about the 2017 NAEP test scores can be accessed via
https://www.nationsreportcard.gov/reading_2017/?grade=4 and
https://www.nationsreportcard.gov/math_2017/?grade=4.

3. Pennsylvania Charter School Demographics

The total number of charter schools in the state of Pennsylvania has remained stable across the study period. Figure 2 notes the newly opened, continuing, and closed charter school campuses from the 2013-14 school year to the 2016-17 year according to the National Center for Education Statistics (NCES).⁸ The figure shows the consistency of total charter schools in Pennsylvania over four years of time.

Figure 2: Opened, Continuing, and Closed Charter Campuses, 2013-14 to 2016-17



The small number of new charter openings or charter school closures creates a stable charter school sector over the study period. Our analysis begins with a total of 181 charter schools in the 2013-14 school year. The 2014-15 school year saw 13 schools closed and four schools opened. In 2015-16, there were four new openings and four closures. In the 2016-17 school year, nine new schools opened, while only two schools closed, leaving the total amount of charter schools to 181.

As a general matter, the demographics of the charter schools may not mirror those of the TPS of Pennsylvania as a whole. This is because charter schools are able to choose their location and thus may

⁸ The data were retrieved from “Public Elementary/Secondary School Universe Survey Data,” National Center for Education Statistics, <https://nces.ed.gov/ccd/pubschuniv.asp>. “Opened schools” indicates schools opened as new schools in the fall of the displayed year. “Continuing schools” indicates schools that were opened prior to the fall of the displayed year and remain open into the next school year (i.e. a school listed as continuing in the 2014-15 column opened some time prior to 2014-15 and did not close in 2014-15) “Closed schools” indicates schools that ceased operation by the spring of the displayed year (i.e. a school listed as closed in the 2014-15 column had its last year of operation in 2014-15 and closed at the end of that school year).

attract a set of students who differ demographically from the overall community profile. Furthermore, charter schools may offer different academic programs and alternate school models which may disproportionately attract particular groups of students relative to TPS. In addition, parents and students choose to attend charter schools for a variety of reasons, such as location, school safety, small school size, academic focus, or special interest programs. The cumulative result of all these forces is that the student populations at charter schools and their TPS feeders may differ.

Table 1 compares student populations in all Pennsylvania traditional public schools (TPS), in those TPS that comprise the set of charter feeder schools, and in the charter schools themselves in the 2015-16 school year.

Table 1: Demographic Comparison of Students in TPS, Feeders, and Charters: 2015-16

	TPS	Feeders	Charters
Number of schools	2,844	1,548	175
Average enrollment per school	553	572	748
Total number of students enrolled	1,573,535	886,205	130,940
Students in Poverty	43%	50%	66%
English Language Learners	3%	4%	3%
Special Education Students	15%	16%	16%
White Students	70%	64%	35%
Black Students	12%	16%	43%
Hispanic Students	10%	12%	16%
Asian/Pacific Islander Students	4%	4%	3%
Native American Students	0%	0%	0%
Multi-Racial Students	3%	4%	4%

The data in Table 1 show the demographic profile of feeder schools is somewhat similar to that of TPS as a whole. The percentage of students in poverty, Black students, and Hispanic students is higher in feeders than in TPS, while the percentage of White students in feeders is lower than in TPS. The demographics in charter schools, however, are very different from that of TPS. Charter schools have a higher percentage of students in poverty as well as a higher percentage of Black students. The percentage of White students in charter schools is lower in charter schools than in TPS.⁹

Policymakers and stakeholders continue to examine the degree to which students with special needs enroll in charter schools. The proportion of students in charter schools receiving special education services is a particular topic of debate. Table 1 shows charter schools have a similar percentage of students receiving special education services compared to both sectors. The impact charter schools have on students with English Language Learner (ELL) designation is also important to policymakers. The ELL student population represents three percent of all TPS students and three percent of the charter school population, respectively.

⁹ Students in poverty in this study are students identified as economically disadvantaged in the state data. In these data, students are either identified as economically disadvantaged or not economically disadvantaged.

Online charter schools have received increasing attention in the educational landscape nationally and in Pennsylvania. With no physical or geographic barriers to enrollment beyond state lines, online charter schools can draw students from across the state and use online instruction as the method of curriculum delivery. People often use the terms “online schools”, “cyber schools”, and “virtual schools” interchangeably. In this study, we use the designation of virtual schools by the National Center for Education Statistics (NCES). According to the definition of NCES (2016, p.9), a school is a virtual school if it is “a public school that only offers instruction in which students and teachers are separated by time or location, and interaction occurs via computers or telecommunications technologies. A virtual school generally does not have a physical facility that allows students to attend classes on site.”¹⁰

Table 2: Demographic Composition of Overall, Brick-and-Mortar, and Online Charter Schools: 2015-16

	Charters	Brick-and-Mortar Charters	Virtual Charters
Number of schools	175	161	14
Average enrollment per school	748	604	2,409
Total number of students enrolled	130,940	97,208	33,732
Students in Poverty	66%	71%	51%
English Language Learners	3%	4%	1%
Special Education Students	16%	15%	18%
White Students	35%	23%	69%
Black Students	43%	52%	17%
Hispanic Students	16%	19%	8%
Asian/Pacific Islander Students	3%	3%	2%
Native American Students	0%	0%	0%
Multi-Racial Students	4%	3%	4%

As shown in a one-year snapshot in Table 2, online charter schools enroll more than 25 percent of all Pennsylvania charter students and serve different student populations than brick-and-mortar charters. Specifically, online charter schools have larger percentages of White students, smaller proportions of Black and Hispanic students, and fewer students living in poverty than brick-and-mortar charters. Students receiving special education services make up 15 percent of students attending brick-and-mortar charter schools while 18 percent of students in online charter schools receive special education services. English Language Learners constitute one percent in Pennsylvania online charters as compared to four percent in brick-and-mortar charters.

¹⁰ National Center for Education Statistics (2016). *Documentation to the 2014-15 Common Core of Data (CCD) Universe Files*. Retrieved from “Public Elementary/Secondary School Universe Survey Data,” <https://nces.ed.gov/ccd/pubschuniv.asp>.

4. Analytic Findings of Charter School Impacts

Overall Charter School Impact

The primary question of this study is whether charter schools differ overall from traditional public schools in how much their students learn. To answer this question, we estimate the one-year academic gains observed for charter school students in each of the three studied growth periods and compare their average performance with the same measure for the VCR students.

Please refer to the sidebar titled *Graphics Roadmap 1* where guidance is provided to help readers understand the charts that follow.

As described in the Study Approach section, student growth data are analyzed in units of standard deviations so that the results can be assessed for statistical differences. To help the reader interpret our analysis results, we transform standard deviation units of growth into days of learning based on a standard 180-day school year (Table 3).¹¹ Interested readers can refer to the Study Approach section and Appendix B for detailed explanations of the computation of days of learning.

Graphics Roadmap 1

The graphics in this section have a common format.

Each graph presents the average performance of charter students relative to their **pertinent comparison students**. The reference group differs depending on the specific comparison being made. Where a graph compares student subgroup performance, the pertinent comparison students are the same for both subgroups. Each graph is labeled with the pertinent comparison group for clarity.

We show two axes on the graphs to help the reader get a sense of learning gains. The **left axis** indicates standard deviation units of learning gains of charter students relative to their comparison students. The **right axis** displays the same learning gains in days of learning. The statistical tests are performed on the values as they are enumerated on the left axis.

The **height** of the bars in each graph reflects the difference in the performance between charter school students and the comparison student.

Stars are used to reflect the level of statistical significance of the difference between the group represented in the bar and its comparison group of similar students in TPS. The absence of stars means that the schooling effect is not statistically different from zero.

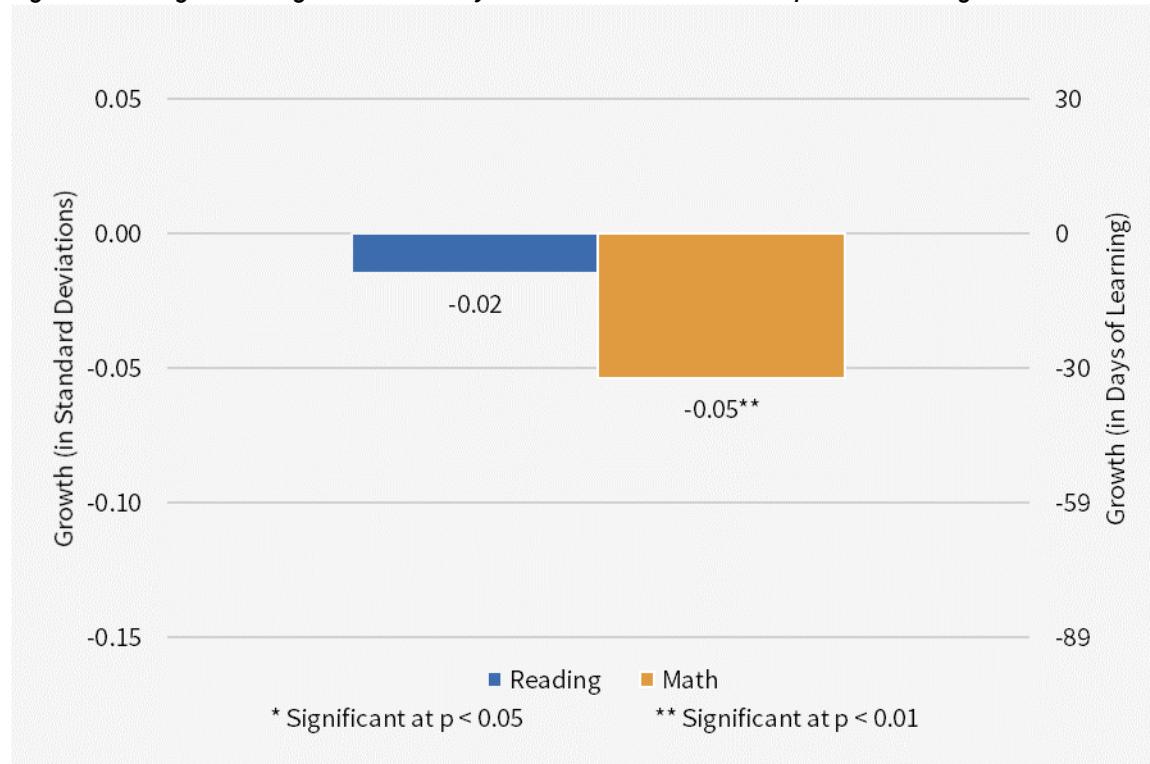
¹¹ The values in Table 3 are updated from past reports using the latest (2017) NAEP scores, which show slower absolute annual academic progress than earlier administrations. See Eric A. Hanushek, Paul E. Peterson, and Ludger Woessmann, “Achievement Growth: International and U.S. State Trends in Student Performance”, *Education Next*, 12 (July 2012), 1–35.

Table 1: Transformation of Average Learning Gains to Days of Learning

Standard Deviations	Days of Learning
0.05	30
0.10	59
0.15	89
0.20	118
0.25	148
0.30	177
0.35	207

Figure 3 displays the overall charter impact on student academic progress in Pennsylvania. The reference group, represented by the 0.00 baseline in the graph, is the average TPS VCRs in the state. Using the results from Figure 3 and the transformations from Table 3, we can see that in a typical school year, charter students in Pennsylvania experience less progress equivalent to 30 fewer days of learning in math in a 180-day school year. Because the difference in growth in reading is not statistically significant, Pennsylvania charter school students experience similar growth in the 180-day period as they would have in a traditional school setting.

Figure 3: Average Learning Gains in Pennsylvania Charter Schools Compared to Average Gains for TPS VCRs

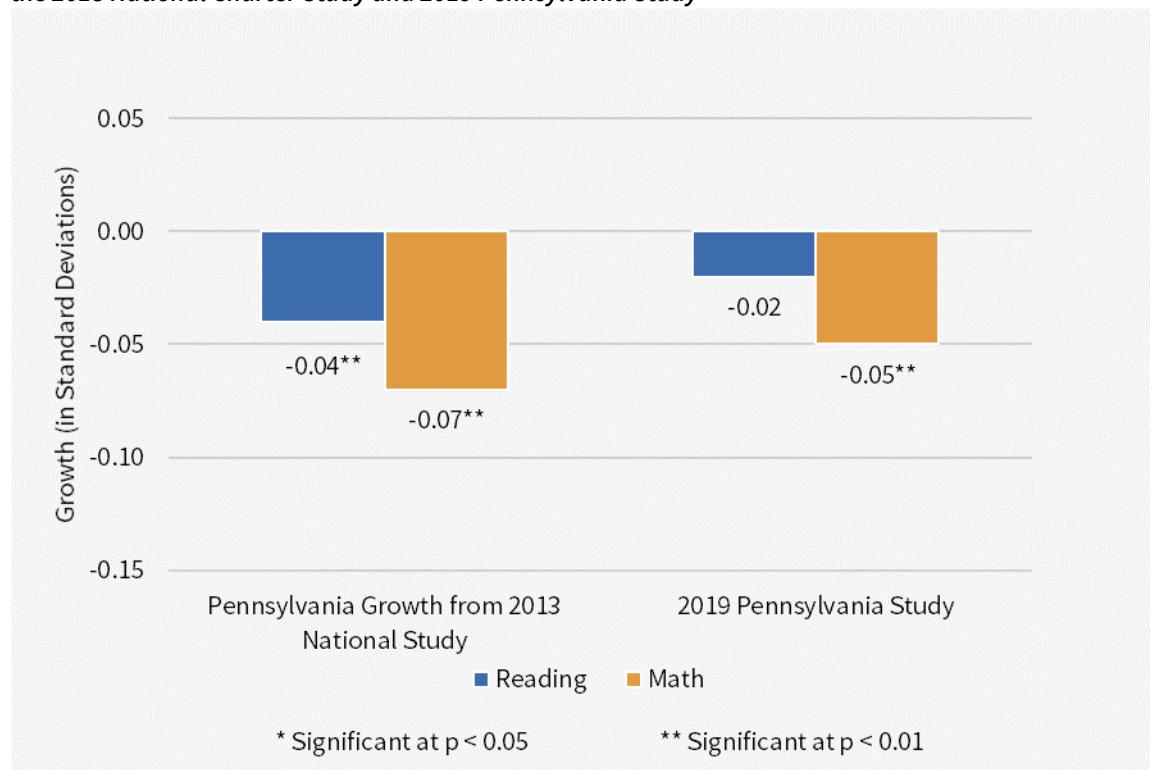


Charter School Impact for the 2014-2017 Cohort

This section compares the performance of Pennsylvania charter schools between two of CREDO's studies: CREDO's 2013 study on national charter school performance¹² and this current 2019 study on Pennsylvania Charter Schools. Figure 4 depicts the academic growth of the Pennsylvania charter sector in the two reports. It is important to note that CREDO also released a Pennsylvania state charter school study in 2011¹³, but there were three years of overlap between the 2011 Pennsylvania study and the 2013 national study. The results found in these two reports closely resemble each other.

As pointed out in the previous section, transformation of growth units of standard deviations into days of learning in this study is updated from past reports, using the most recent NAEP scores. Therefore, only growth in standard deviations is shown in Figure 4. In addition, as explained in the Study Approach chapter, we slightly adjust our VCR method in this study by matching a charter student by period to comply with the WWC Version 4.0 revised requirement for baseline equivalence. Therefore, the comparison of the overall charter effect across two reports is not purely comparable.

Figure 4: Average Learning Gains in Pennsylvania Charter Schools Compared to Average Gains for TPS VCRs from the 2013 National Charter Study and 2019 Pennsylvania Study



¹² Cremata, Edward, D. Davis, K. Dickey, K. Lawyer, Y. Negassi, M. Raymond and J. Woodworth (2013). *National Charter School Study 2013*. <https://credo.stanford.edu/documents/NCSS%202013%20Final%20Draft.pdf>.

¹³ Charter School Performance in Pennsylvania, CREDO (Center for Research on Education Outcomes), Stanford University, April 6, 2011, http://credo.stanford.edu/reports/PA%20State%20Report_20110404_FINAL.pdf

Figure 4 indicates some changes in the academic progress of Pennsylvania charter school students between the two studies. In reading, charter students register weaker learning gains compared to their TPS peers in the 2013 national study, while charter school students in this study perform similarly to their TPS peers. In math, charter school students made less progress than their TPS VCR twins in the two studies, with the gap slightly smaller in the current study.

Charter School Impact by Growth Period

To determine whether performance is consistent over the window of this study, the impact of attending a charter school on academic progress is examined separately for each of the three growth periods. Recall that a growth period is the measure of progress from one school year to the next. In the presentation of results in Figure 5, the denotation "2014-2015" covers academic growth that occurred between the end of the 2013-2014 school year and the end of the 2014-2015 school year. Similarly, the denotation "2016-2017" corresponds to the year of growth between the 2015-2016 and the 2016-2017 school years.

Figure 5: Learning Gains in Pennsylvania Charter Schools Compared to Gains for TPS VCRs by Growth Period: 2014-2015 to 2016-2017

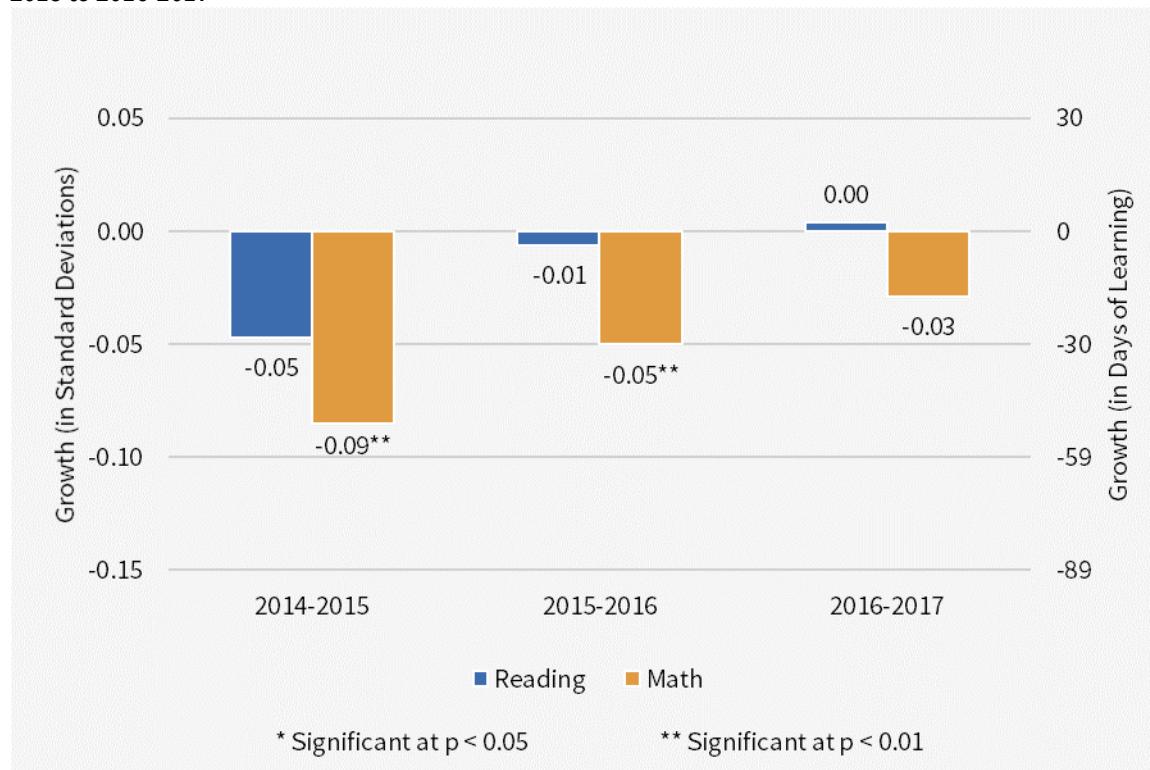


Figure 5 reveals charter school students performing similarly to their VCR peers in reading for all growth periods covered in this report. In math, however, charter school students perform significantly worse in the first two growth periods. In the 2014-2015 growth period, students attending charter schools experienced approximately 53 fewer days of learning in math, while in the 2015-2016 growth period,

students attending charter schools experienced approximately 30 fewer days of learning in math, compared to their VCR peers. In the final growth period in our analysis, charter school students perform similarly to their VCR peers in math.

5. Charter School Analysis by School Attribute

Charter School Impact by School Locale

While charter schools exist in a variety of locales in the state of Pennsylvania, charter schools in urban areas often receive the bulk of media attention. It is important to note that charter schools in different locales may serve different student populations and face different obstacles related to available human capital. The results in Figure 6 represent the disaggregated impacts of charter school enrollment for urban, suburban, town, and rural charter schools. In this breakdown, charter students in different locations are compared with the VCR peers.¹⁴ For the following analysis, the comparison is relative to the actual progress each group of VCRs realized. But the reader should not assume that the transformation of each VCR group to 0.00 means that all the VCRs have equivalent academic growth.

¹⁴ The National Center for Education Statistics (NCES) defines 12 urban-centric locales which are divided into four main locale types: city, suburb, rural and town. Each school's locale is coded by NCES in the annual Core of Common Data dataset; we use their classification for this analysis. One important caveat is that online charter schools are assigned the local of their administrative office, though their students can be located in any location.

Figure 6: Learning Gains in Pennsylvania Charter Schools Compared to Gains for TPS VCRs by School Locale

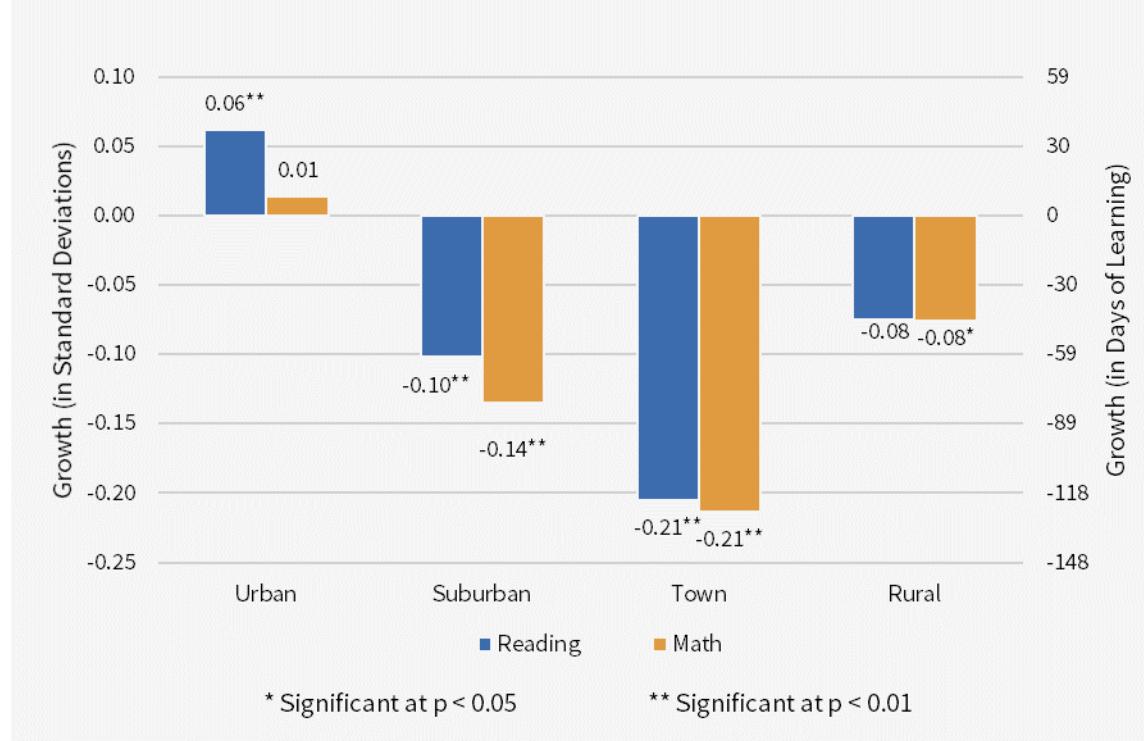


Figure 6 shows urban charter students post reading growth equivalent to 35 more days of learning and perform similarly in math compared to their TPS counterparts. Students attending charter schools in the suburbs have significantly weaker growth in both subjects compared to their TPS VCRs. They experience about 59 fewer days of learning in reading and about 83 fewer days of learning in math. Students attending charter schools residing in towns experience about 124 fewer days of learning in both reading and math compared to their TPS peers. Students attending charter schools in rural settings have similar growth to their TPS peers in reading, while experiencing 47 fewer days of learning in math compared to their TPS peers. Refer to Appendix Table 1 for the number of student observations in each locale-subject combination.

Charter School Impact by School Grade Configuration

Charter schools often exercise their autonomy by choosing which grade levels to serve. Some charter operators focus on particular ages, some seek to serve a full range of grades, and others develop by adding one additional grade each year. The National Center for Education Statistics assigns schools the label of “elementary school”, “middle school”, “high school”, or “multi-level school” based on their predominant grade pattern. The designation of “multi-level school” can apply to a school that serves elementary and middle grades, middle and high grades, or all K-12 grades.¹⁵ Looking at performance by school grade configuration helps inform us whether specialization in a specific range of grades

¹⁵ The National Center for Education Statistics (NCES) designates a school as an elementary, middle, high, or multi-level school. CREDO uses the designation by NCES. The sole exception is that CREDO considers a school to be a high school if the lowest grade served is ninth grade or above.

produces better results. The outcomes of students by the grade configuration of the charter school they attend are reported in Figure 7. Again, the comparison is relative to whatever actual progress each group of VCRs realized. The reader should not assume that the transformation of each VCR group to 0.00 means that all the VCRs have equivalent academic growth.

Figure 7: Learning Gains in Pennsylvania Charter Schools Compared to Gains for TPS VCRs by School Grade Configuration

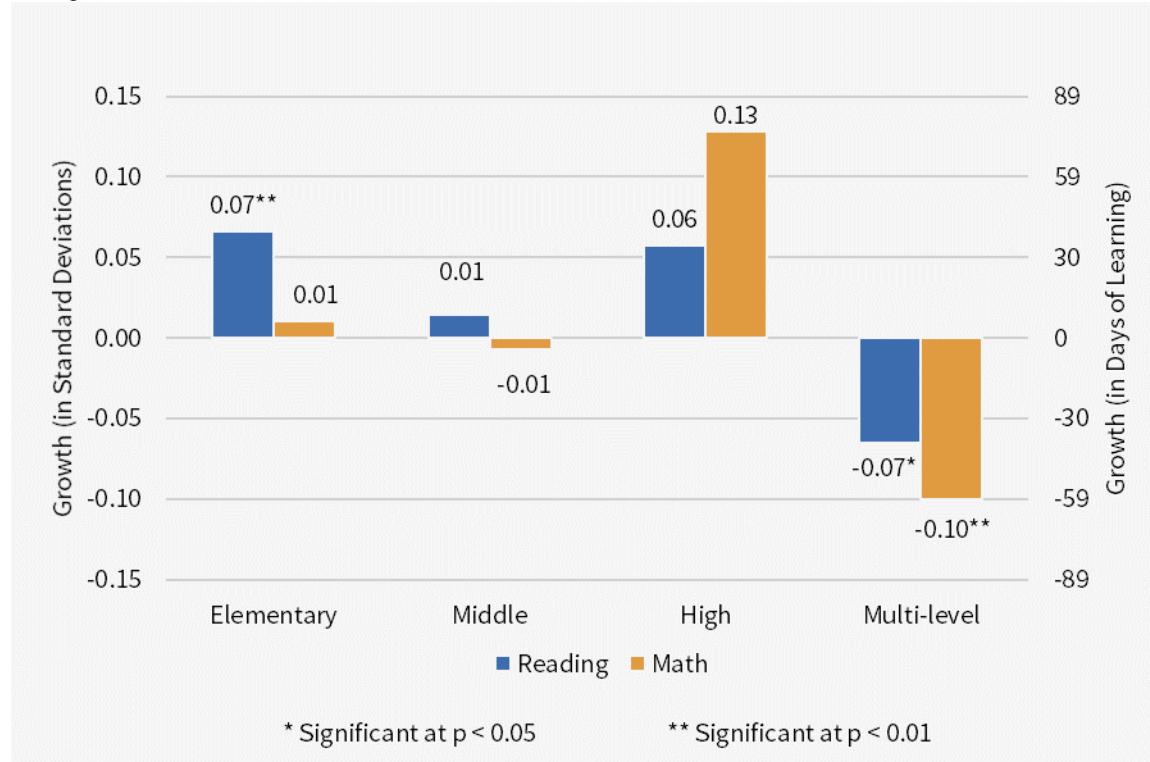


Figure 7 shows that, on average, students in charter elementary schools experience greater growth than their TPS peers in reading, while performing similarly to their TPS peers in math. These students attending elementary charter schools experience about the equivalent of 41 more days of learning in reading. Students attending charter middle schools and charter high schools perform similarly in both reading and math compared to their VCR peers. Students attending charter multi-level schools experience significantly weaker growth in both reading and math compared to their TPS peers. These students experience about the equivalent of 41 fewer days of learning in reading and about 59 fewer days of learning in math.

6. Charter School Analysis by Student Characteristic

Charter School Impact by Race/Ethnicity

Since the federal government's passage of the *No Child Left Behind Act* in 2001, stakeholders have used annual achievement tests to examine the gaps in achievement levels for students of specific racial and ethnic backgrounds. Part of the rationale of schools of choice such as charter schools has been the exploration of vehicles to lessen those achievement gaps. Pennsylvania's diverse population as shown in Table 1 illustrates the need for this report to focus on the ability of charter schools to support the progress of disadvantaged students. The effectiveness of charter schools across ethnic and racial groups is especially important given the significant shares of historically underserved students charter schools enroll.

The impacts of charter schools on the academic gains of Black and Hispanic students are reported in Figures 8 through 9a. For each student subgroup, we present two related graphs. *Graphics Roadmap 2* in the sidebar provides guidance on how to interpret the graphs and their relation to each other. In short, the first graph depicts the growth of TPS students and charter students in the particular subgroup of interest as compared to the growth of the "average White TPS student". Graphs labeled "a" show whether the learning gains in the charter school student subgroup differ significantly from their VCRs in the same subgroup.

Black students account for 43 percent of the charter school population in Pennsylvania. Figure 8 shows the performance of Black students – regardless of their enrollment – compared to the performance of White students in TPS, our benchmark group. Black students in TPS have significantly weaker growth in both subjects compared to that of the average White student in TPS. Black students in TPS experience about the

Graphics Roadmap 2

Figures 8 through 9a show two important contrasts for Black and Hispanic student groups. For each student subgroup, we present two related graphs:

The **first graph** displays the growth of **TPS students and charter students in the particular subgroup** of interest compared to the growth of the "**average White TPS student**." In this comparison, the White TPS student is male and is not in poverty, special education, or designated as an English Language Learner and is not repeating his current grade. The graph sets the performance of the average White TPS student to **zero** and shows how learning of students in the subgroup compares.

The **stars** indicate the level of statistical significance. Thus, if there are no stars, we interpret the difference in learning gains as similar to the white TPS comparison student. The size and direction of the **bars** in the graph show the direction and magnitude of learning differences. If there is no difference in the learning gains, the bar would be missing entirely. If the learning of the student group in question is not as great as the comparison baseline, the bar is negative. If the learning gains exceed the comparison, the bar is positive.

Graphs labeled "a" display the results of a second comparison testing whether the learning gains in the **charter school student subgroup** differ significantly from **their VCRs in the same student subgroup**. In these graphs, the performance of the TPS peers in the subgroup are set to **zero** and the learning gains of the charter school students in the subgroup are measured against that baseline. As with the first graph, stars denote statistical significance.

equivalent of 112 fewer days of learning in reading and about 106 fewer days of learning in math compared to the average White VCR student. Black students attending charter schools in Pennsylvania also exhibit weaker growth compared to the average White student in TPS, amounting to about 89 fewer days of learning in reading and about 118 fewer days of learning in math. We refer to these differences as *learning gaps*. They have a direct impact on achievement gaps over time.

Figure 8: Learning Gains of Black Students in TPS and Charters Benchmarked against Learning Gains of White TPS Students

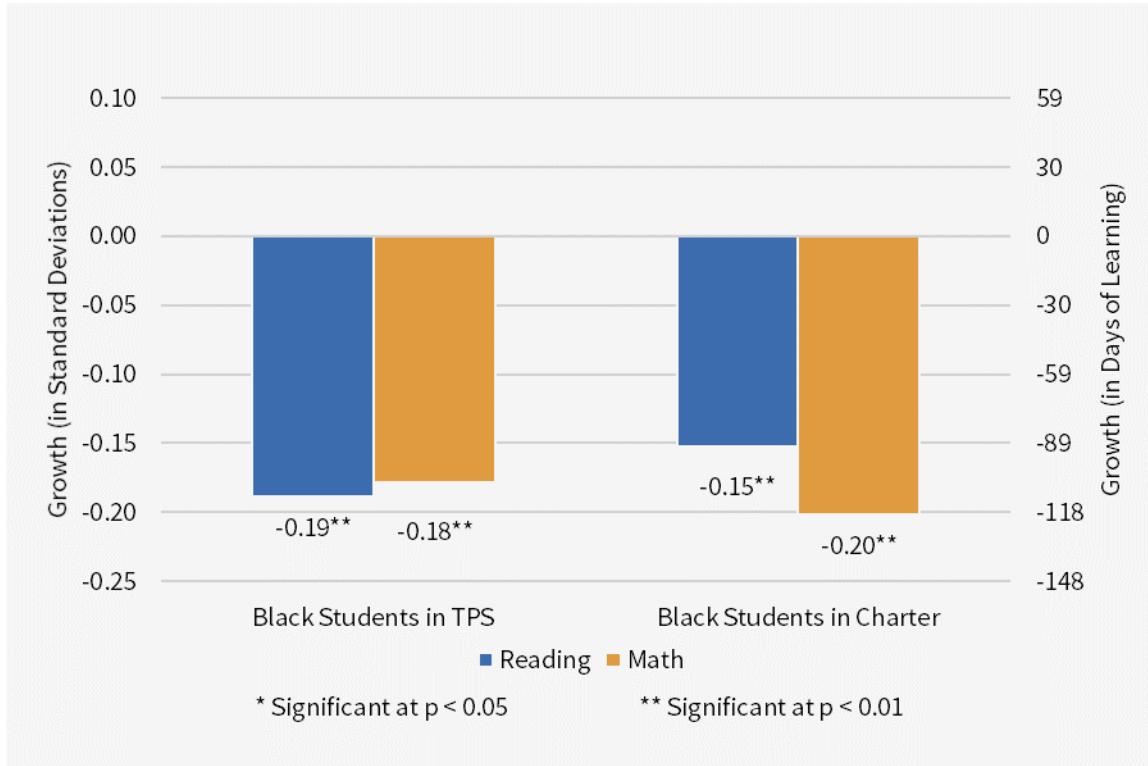
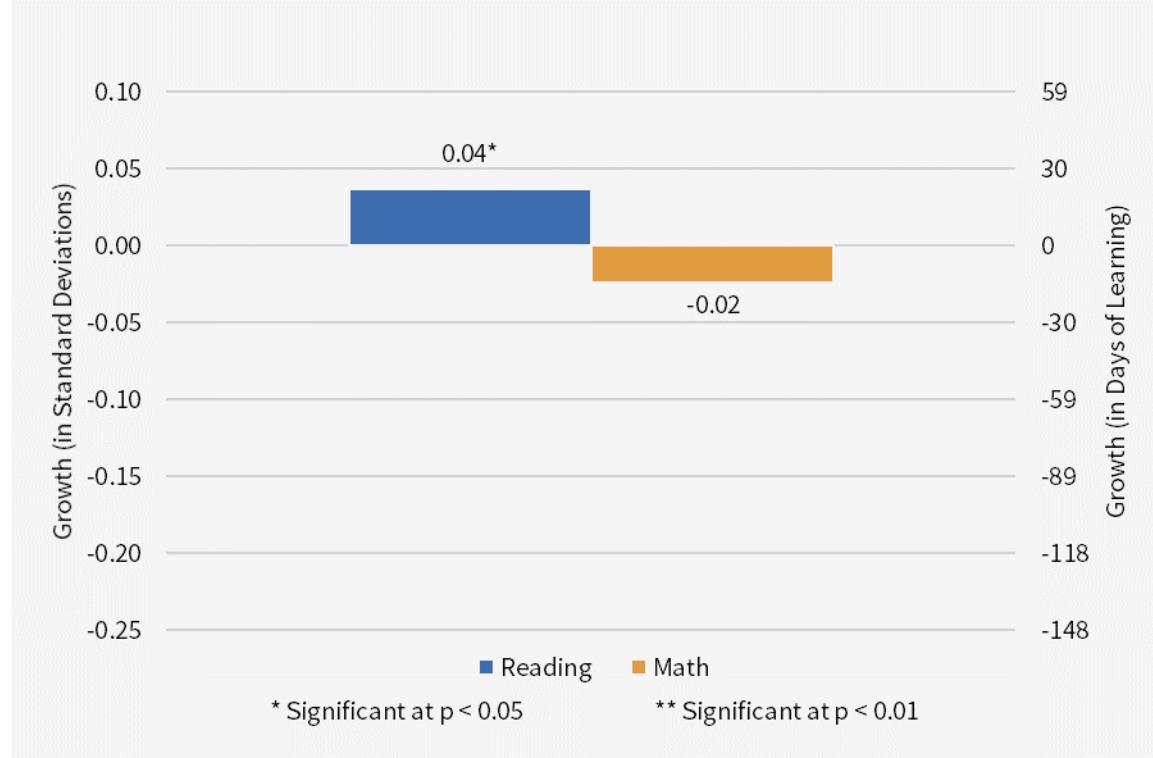


Figure 8a shows the learning gains of Black students enrolled in charter schools as compared to those of Black students enrolled in TPS. Black charter students experience greater yearly progress in reading while performing similarly in math compared to their Black TPS peers. The stronger growth in reading for Black charter students compared to their Black peers translates to about 24 additional days of learning.

Figure 8a: Relative Learning Gains for Black Charter School Students Benchmarked against Their Black TPS Peers



Hispanic students account for 16 percent of the charter school population in the state of Pennsylvania. Figure 9 shows that Hispanic students exhibit weaker growth than the average White TPS student in both subjects, whether they attend TPS or charter schools. In reading, Hispanic students in TPS experience 83 fewer days of learning while Hispanic students in charter schools experience 71 fewer days of learning compared to the average White TPS student. In math, Hispanic students in TPS lag behind White VCR students by about 89 days, while Hispanic students in charter schools lag behind White TPS students by about 100 days.

Figure 9: Learning Gains of Hispanic Students in TPS and Charters Benchmarked against Learning Gains of White TPS Students

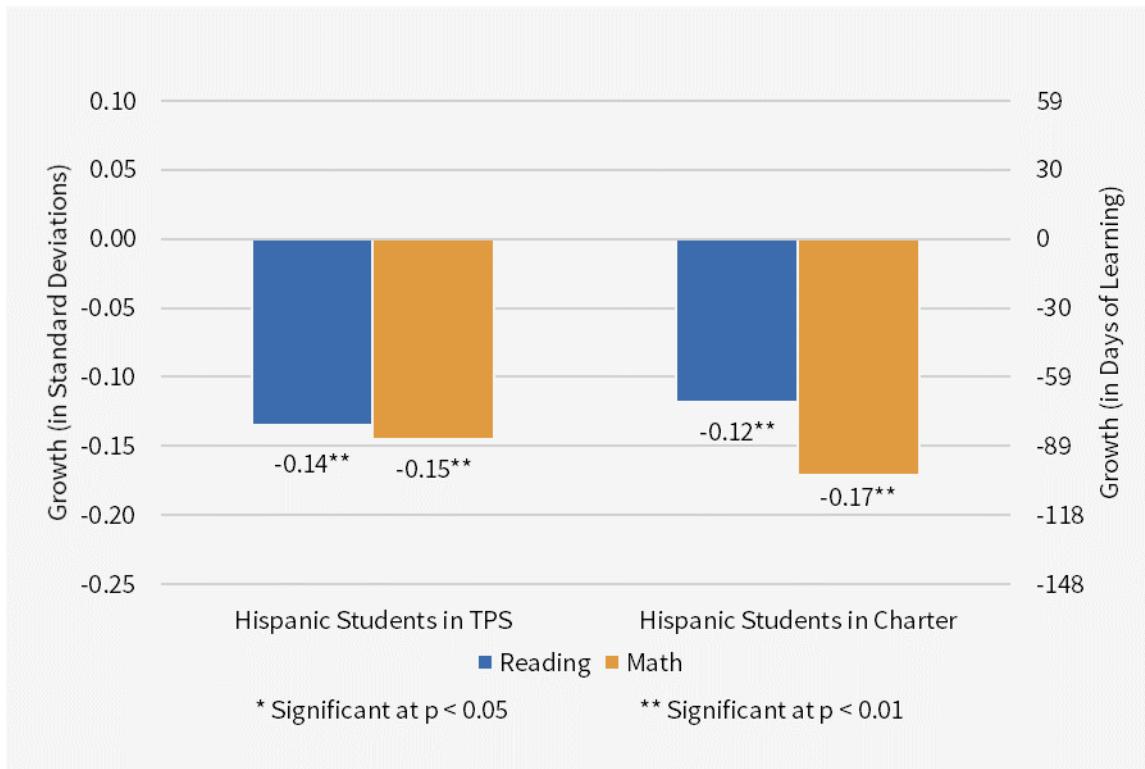
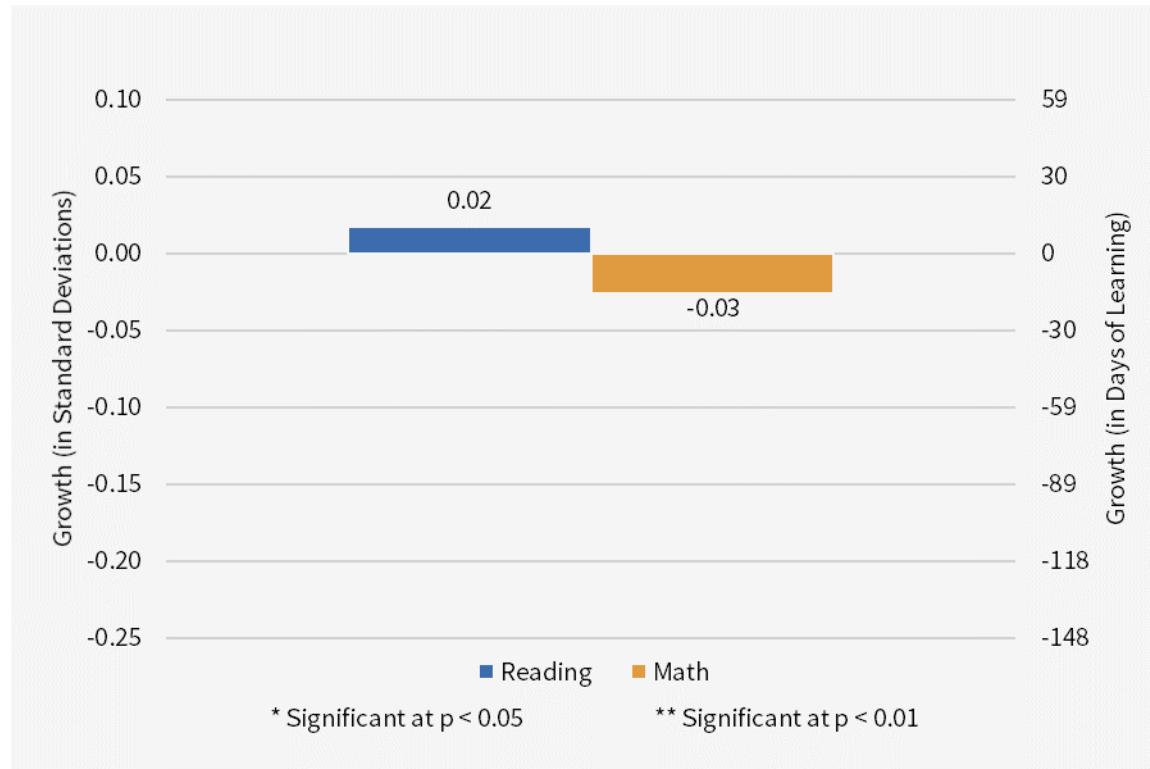


Figure 9a displays the differences in learning gains between charter school Hispanic students and Hispanic peers enrolled in TPS. In both subjects, Hispanic students attending charter schools in Pennsylvania perform similarly to their Hispanic peers attending TPS.

Figure 9a: Relative Learning Gains for Hispanic Charter School Students Benchmarked against Their Hispanic TPS Peers



Black students and Hispanic students, regardless of the school sector they attend, both experience weaker growth compared to white students in TPS. Black students in charter schools outperform their Black peers in TPS in reading while performing similarly in math. Hispanic students in charter schools do not differ in growth compared to their Hispanic peers in TPS.

Charter School Impact with Students in Poverty

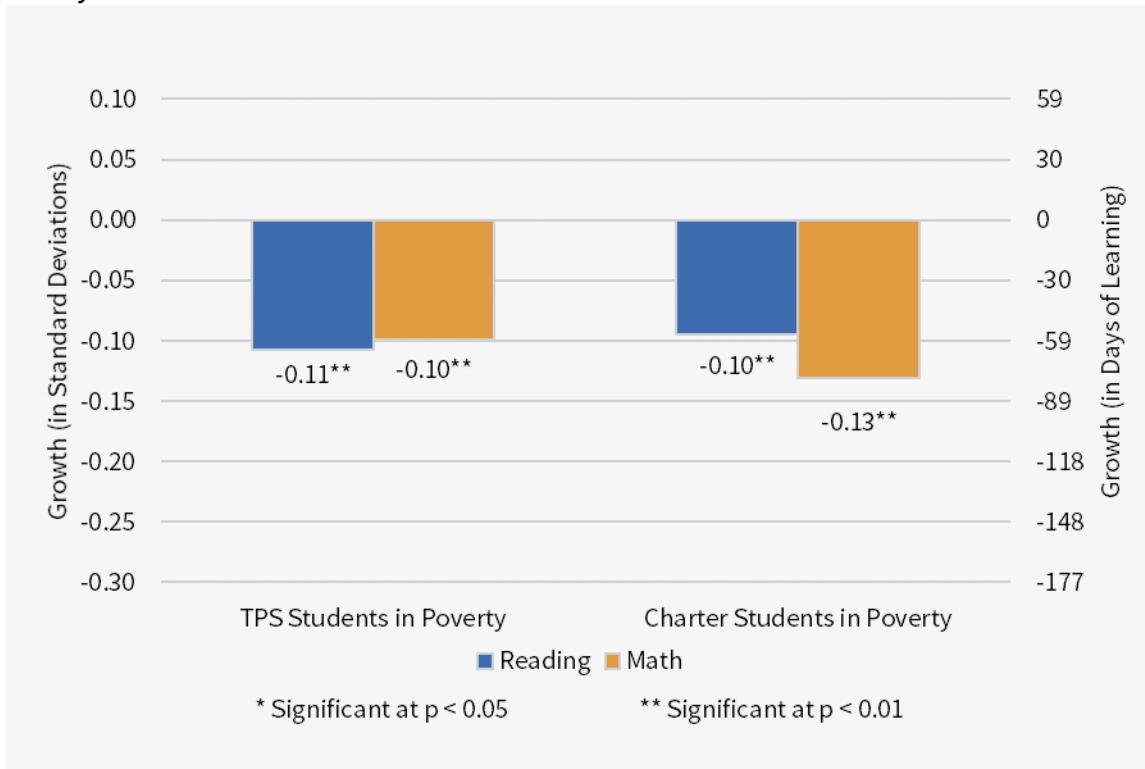
Many charter schools aim to improve educational outcomes for traditionally underserved students, especially for students in poverty. According to the latest data collected by the National Alliance for Public Charter Schools, students in poverty account for 55 percent of the national charter school population.¹⁶ By comparison, in Pennsylvania 66% of students attending charter schools are in poverty compared to 43% of TPS students.

Figure 10 presents the annual academic growth for students in poverty. It is important to note that in this graph, the benchmark differs from the race/ethnicity graphs presented earlier: it is a TPS student

¹⁶ The data were retrieved from “National Charter School Facts,” National Alliance for Public Charter Schools, <https://data.publiccharters.org/> when the report was produced.

who is not in poverty. This analysis isolates the relationship between poverty and growth. This provides a picture of the difference in the impact of charter attendance on students in poverty compared to similar students in TPS who are not in poverty.

Figure 10: Overall Learning Gains for TPS and Charter Students in Poverty Compared to TPS Students Not in Poverty



The results in Figure 10 illustrate differences in growth between students in poverty and TPS students who are not in poverty. Students in poverty attending TPS experience 65 fewer days of learning in reading and 59 fewer days of learning in math compared to TPS students not in poverty. Students in poverty attending charter schools experience 59 fewer days of learning in reading and 77 fewer days of learning in math compared to TPS students not in poverty.

Figure 10a: Relative Learning Gains for Charter School Students in Poverty Benchmarked against Their TPS Peers in Poverty

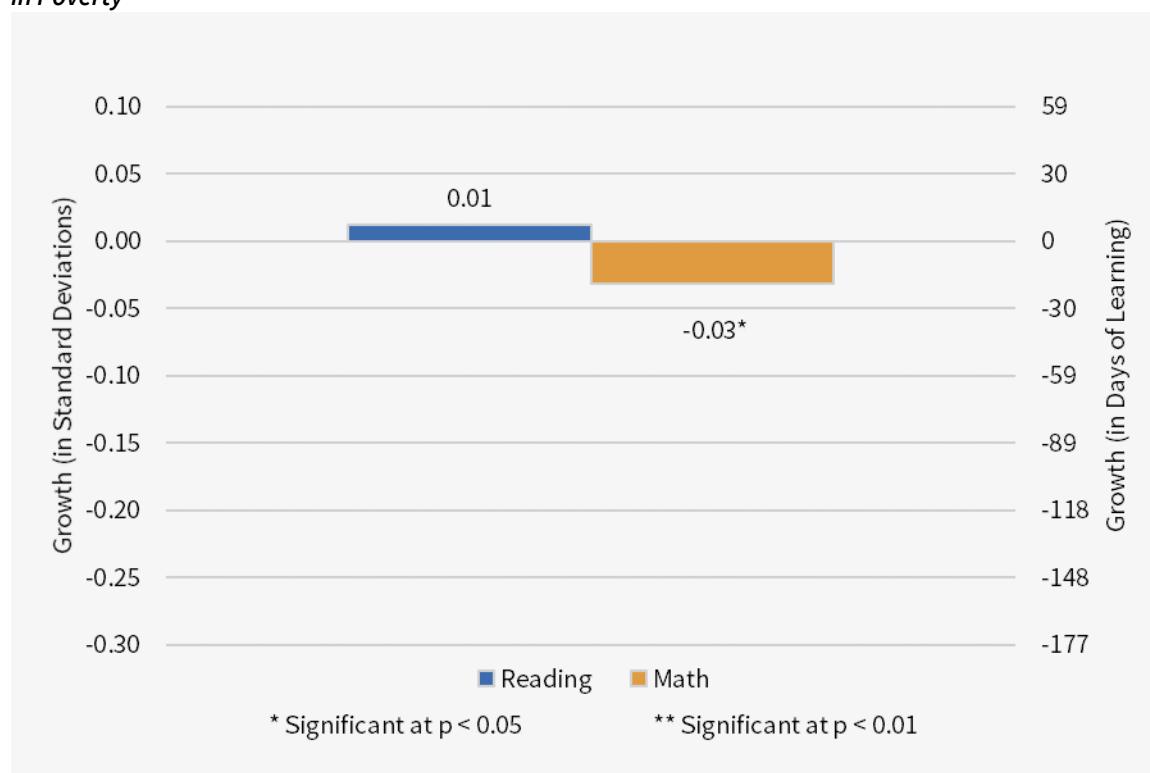


Figure 10a shows the difference in growth between charter school students in poverty and TPS students in poverty. In reading, charter school students in poverty perform similarly to their TPS peers in poverty. In math, however, charter school students in poverty have significantly weaker growth, equivalent to about 18 fewer days of learning.

Charter School Impact with Combined Race/Ethnicity and Poverty

In public education, some of the most academically challenged students are those who are both living in poverty and are members of historically-underserved racial or ethnic minorities. According to the National Center for Education Statistics, Black and Hispanic students comprise the two race/ethnicity subgroups with the largest percentages of school-aged children in poverty. In 2015, 36 percent of Black children and 31 percent of Hispanic children were living in poverty.¹⁷ To examine the extent to which performance gaps are being addressed in Pennsylvania, we further disaggregate the charter school impact on Black and Hispanic students in poverty.

The impact of Pennsylvania charter schools on the academic gains of black students in poverty is presented in Figures 11 and 11a. The impact of charter schools on Hispanic students living in poverty is shown in Figures 12 and 12a.

¹⁷ Kids Count Data Center | Annie E. Casey Foundation (2016). <http://datacenter.kidscount.org/data/tables/44-children-in-poverty-by-race-and-ethnicity#detailed/1/any/false/573,869,36,868,867/10,11,9,12,1,185,13/324,323>

Figure 11: Learning Gains of Black TPS and Charter Students in Poverty Compared to Learning Gains of White TPS Students Not in Poverty

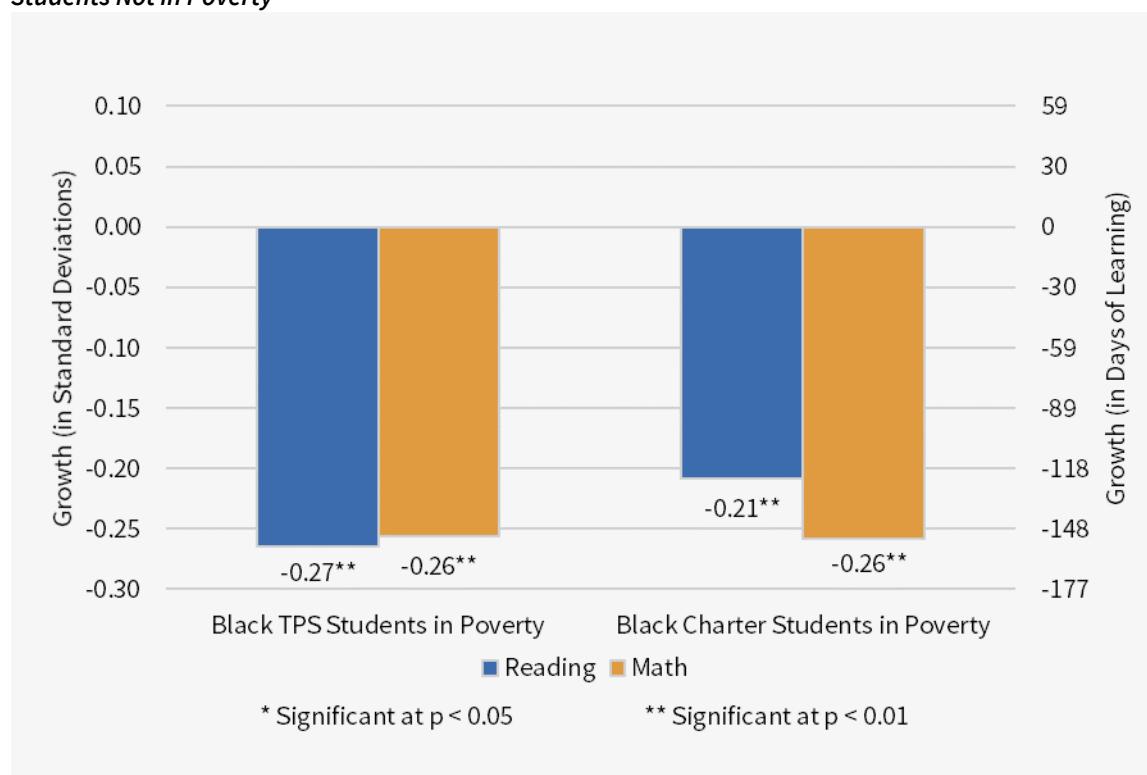
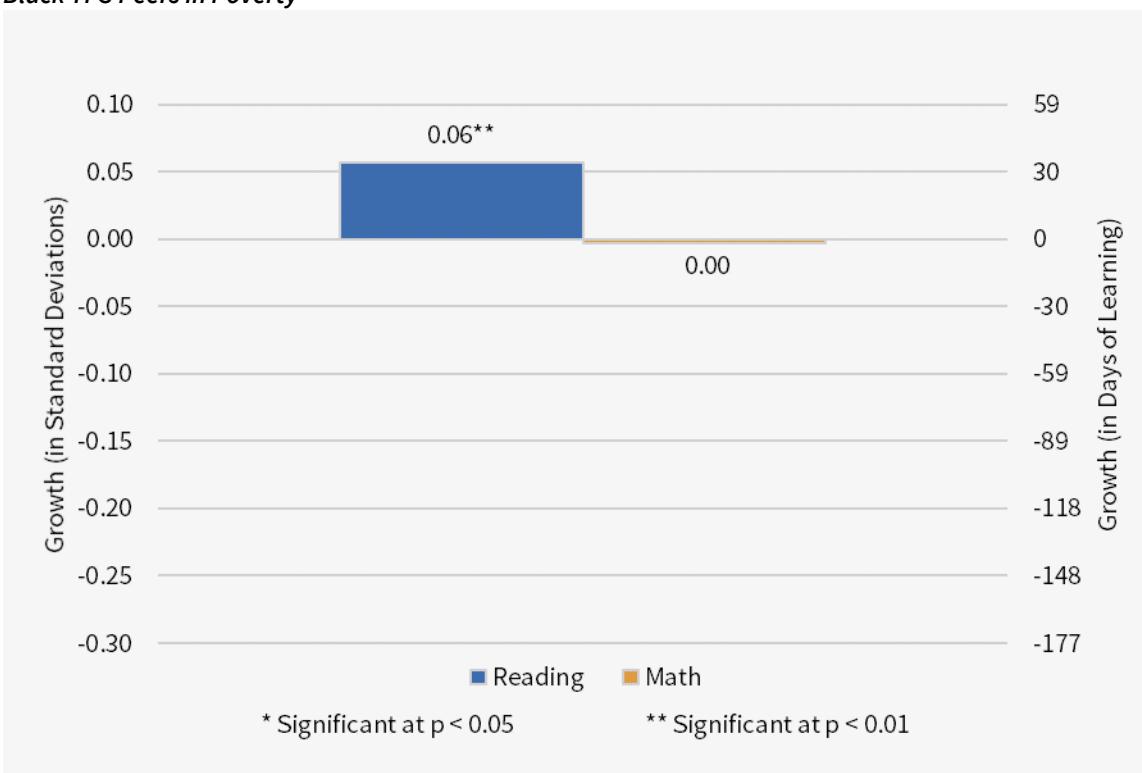


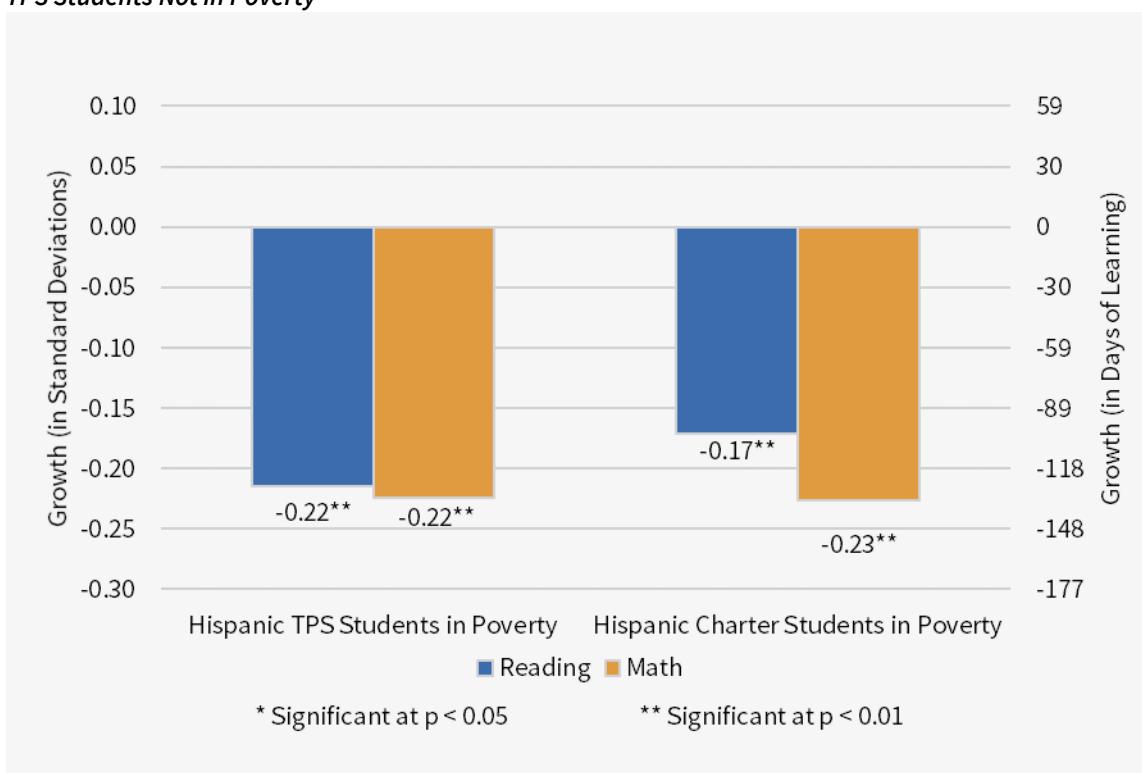
Figure 11 compares black students living in poverty, enrolled in TPS or charter schools, with the average White TPS student who is not in poverty. The patterns show that in Pennsylvania, black students living in poverty, regardless of TPS or charter enrollment, have significantly weaker growth compared to White TPS students who are not in poverty. Black TPS students in poverty exhibit approximately 159 fewer days of learning in reading and 153 fewer days of learning in math than White TPS students not living in poverty. Black charter students in poverty experience 124 fewer days of learning in reading and 153 fewer days in math than White non-poverty TPS students. The magnitude of these results is notable. These students show the aggravated negative effect of their doubly disadvantaged status.

Figure 11a: Relative Learning Gains for Black Charter School Students in Poverty Benchmarked against Their Black TPS Peers in Poverty



When comparing black students in poverty attending charter schools to black students in poverty attending TPS, there is a positive charter effect in reading and no difference in the math growth. The results for this comparison are presented in Figure 11a. In reading, black students in poverty attending charter schools gain about 35 additional days of learning compared to their black TPS peers in poverty. In math, there is no difference in the average growth between the two groups.

Figure 12: Learning Gains of Hispanic TPS and Charter Students in Poverty Compared to Learning Gains of White TPS Students Not in Poverty



As shown in Figure 12, Hispanic students in poverty, regardless of enrollment in charter schools or TPS, have significantly weaker growth in both reading and math compared to White non-poverty students in TPS. Hispanic TPS students in poverty lag behind their White non-poverty TPS peers at a rate equivalent to 130 less days of learning in both reading and math. Hispanic Charter students in poverty experience weaker gains at the rate of 100 fewer days of learning in reading and 136 fewer days of learning in math compared to White students in TPS.

Figure 12a: Relative Learning Gains for Hispanic Charter School Students in Poverty Benchmarked against Their Hispanic TPS Peers in Poverty

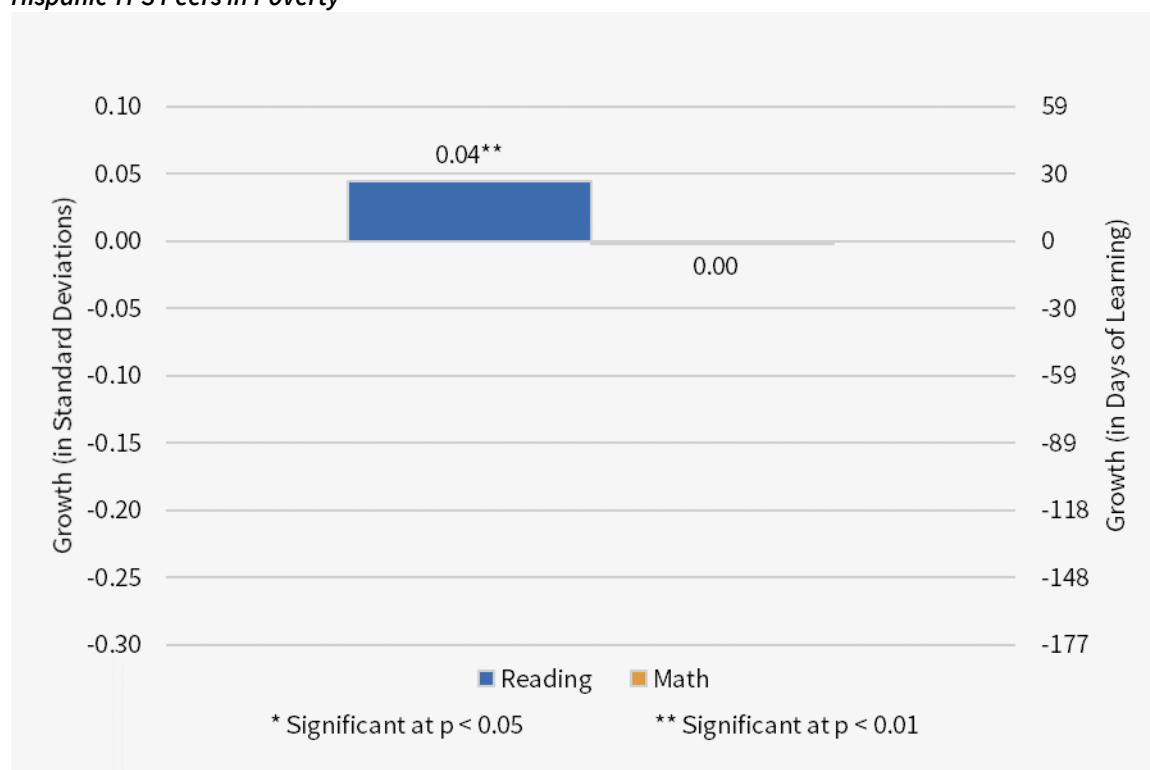
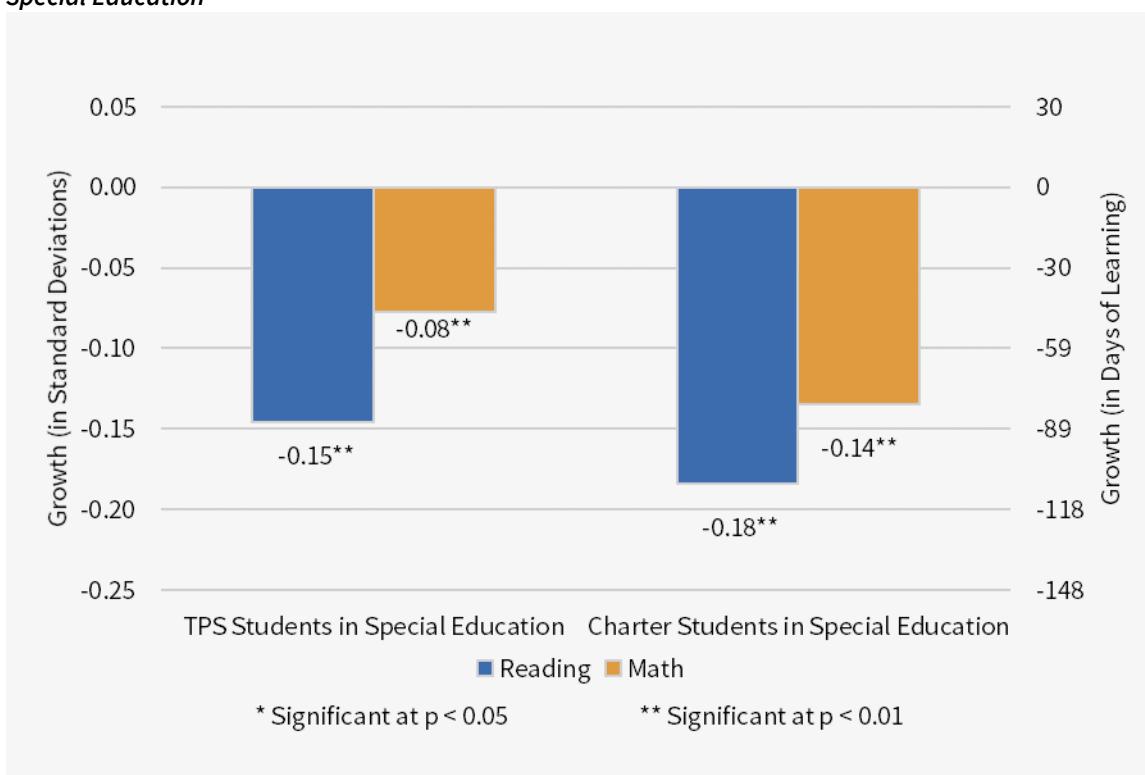


Figure 12a shows that Hispanic students in poverty attending charter schools gain about 24 days of learning in reading and have similar growth in math when compared to Hispanic students in poverty attending TPS.

Charter School Impact with Special Education Students

In Pennsylvania, 15 percent of TPS students and 16 percent of charter school students receive special education services. Ideally, we would compare outcomes for each Individual Education Program (IEP) designation. Unfortunately, that approach is not feasible due to the large number of categories and the relatively small number of students in each. Faced with this challenge, we aggregate across all categories of special education. Therefore, the results of this section should be interpreted with caution.

Figure 13: Learning Gains for TPS and Charter Students in Special Education Compared to TPS Students Not in Special Education



In Figure 13, we benchmark TPS students receiving special education services and charter students receiving special education services to the TPS VCRs who do not receive special education services. Students in special education attending Pennsylvania public schools, regardless of sector, experience weaker growth compared to their non-special education TPS peers. Students in special education attending a TPS experience about the equivalent of 89 fewer days of learning in reading and about 47 fewer days of learning in math compared to TPS students who are not in special education. Special education students attending charter schools experience about 106 fewer days of learning in reading and about 83 fewer days of learning in math compared to their TPS students not receiving special education services.

Figure 13a: Relative Learning Gains for Charter Students in Special Education Benchmarked against Their TPS Peers in Special Education

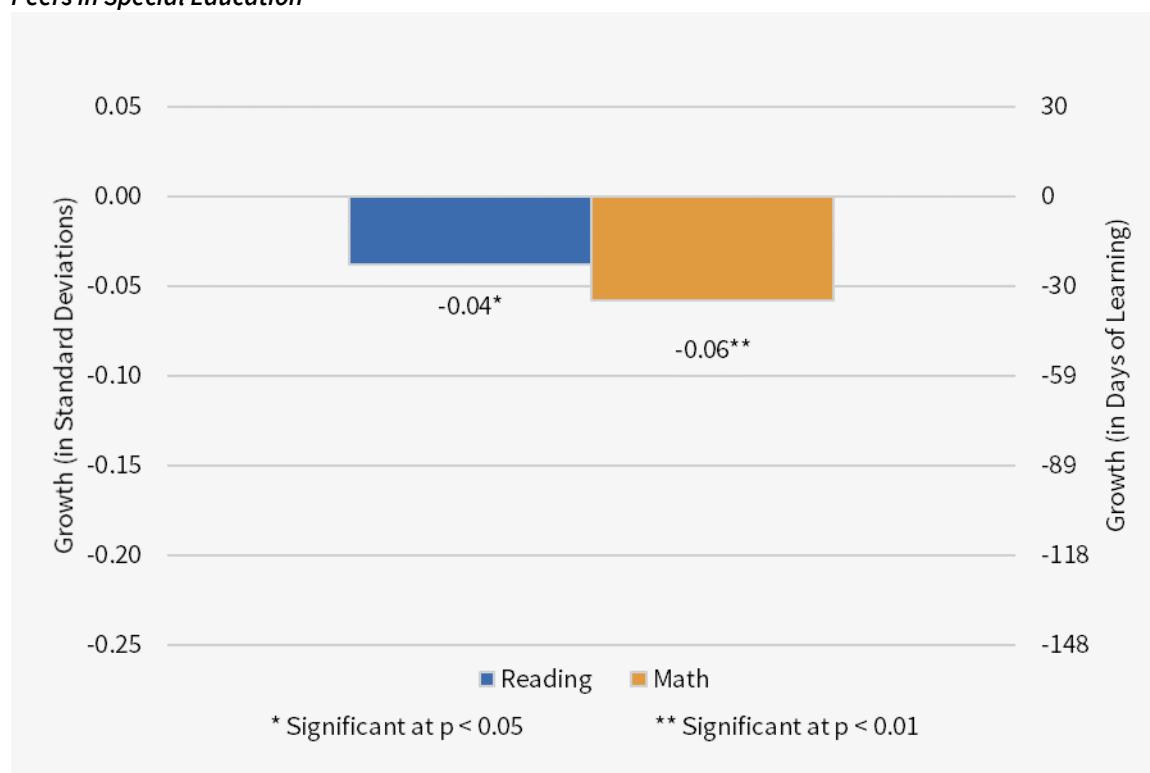


Figure 13a represents the growth of special education students attending charter schools compared to special education students attending TPS. Charter school students receiving special education services have significantly weaker growth compared to their TPS peers in both reading and math. Charter special education students experience about 24 fewer days of learning in reading and about 35 fewer days of learning in math compared to their TPS peers also receiving special education services.

Charter School Impact with English Language Learners

The 2017 National Assessment of Education Progress (NAEP) documented the performance gap between English Language Learners (ELL) and their English-proficient peers, showing ELL students have weaker performance.¹⁸ The analyses presented in Figure 14 and Figure 14a highlight differences in ELL students in charter schools and ELL students in TPS.

¹⁸ The Nation's Report Card (2018). 2017 Mathematics and Reading Assessments
https://www.nationsreportcard.gov/math_2017/nation/gaps/?grade=4#?grade=4.

Figure 14: Learning Gains for TPS and Charter ELL Students Compared to TPS Non-ELL Students

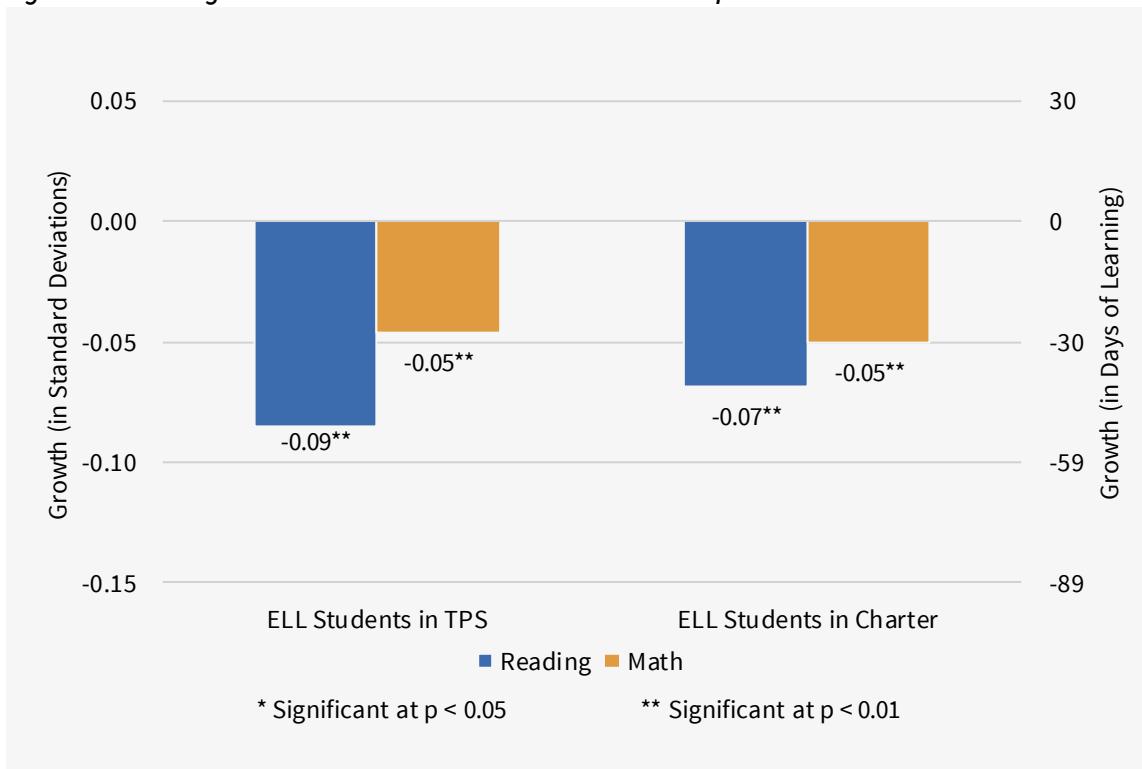


Figure 14 shows that regardless of sector, English Language Learners in Pennsylvania public schools exhibit weaker growth in both reading and math compared to TPS students who are English proficient. ELL students enrolled in TPS have about 53 fewer days of learning in reading and about 30 fewer days of learning in math compared to TPS English-proficient students. ELL Students in charter schools have about the equivalent of 41 fewer days of learning in reading and 30 fewer days of learning in math compared to English-proficient students attending TPS. Figure 14a below shows that charter school students with ELL designation and TPS students with ELL designation have similar growth in both reading and math.

Figure 14a: Relative Learning Gains for Charter ELL Students Benchmarked against Their TPS ELL Peers

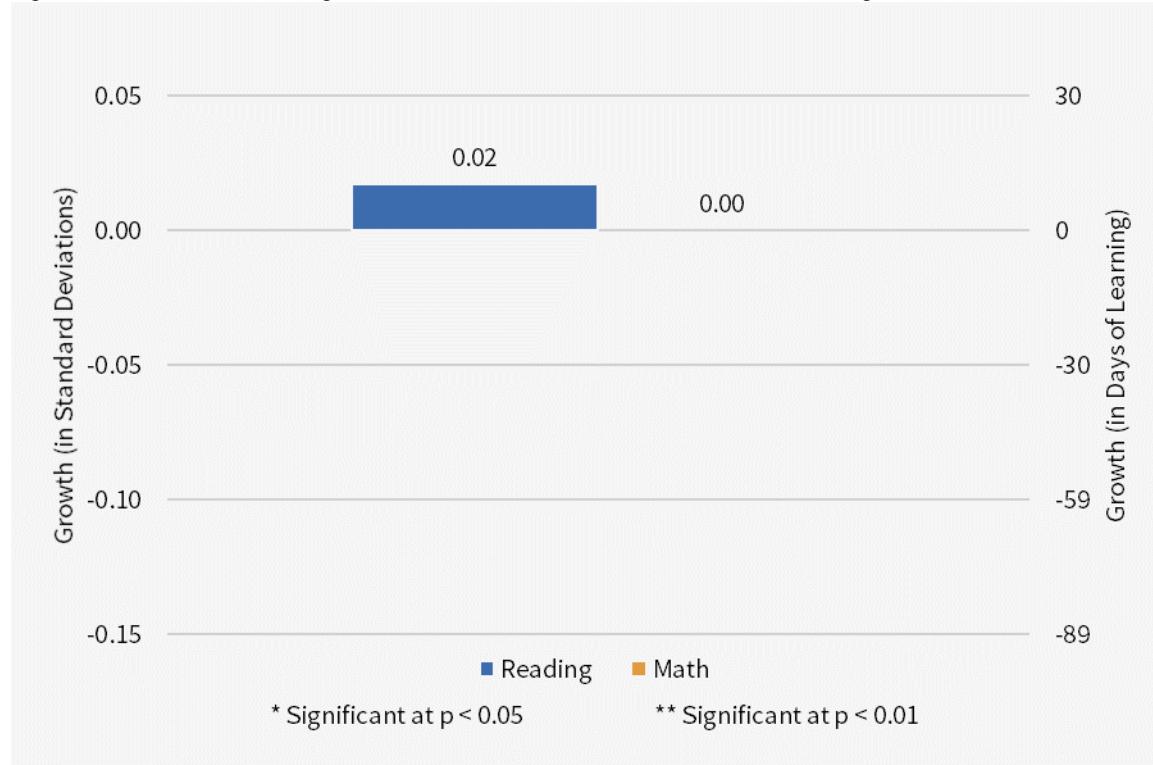


Table 4 summarizes the effect that charter schools have on different student groups. The results represent the growth of each group relative to their peer group in TPS. Black students in charter schools, for example, experience additional reading growth of .04 (24 days) compared to Black students in TPS.

Table 4: Charter School Impacts on Student Subgroup Learning Gains

Student Group	Charter School Effect on Student Groups Benchmarked against their TPS Peers	
	Reading	Math
Overall Charter School Effect	-0.02	-0.05**
Charter School Students in Poverty	0.01	-0.03*
Black Charter Students	0.04*	-0.02
Black Charter Students in Poverty	0.06**	0.00
Hispanic Charter Students	0.02	-0.03
Hispanic Charter Students in Poverty	0.04**	0.00
Special Education Charter Students	-0.04*	-0.06**
English Language Learner Charter Students	-0.02	-0.01

Charter School Impact by Students' Years of Enrollment

The academic growth of students attending charter schools may change along with the number of years a student is enrolled in a charter school. To test the relationship between progress and the length of enrollment in a charter school, we separately group test scores from students in the first year of charter enrollment, scores from students in their second year of charter attendance, and scores of students in their third year in a charter school. In this scenario, the analysis is limited to the charter students who enroll for the first time in a charter school between the 2014-15 and 2016-17 school years and their TPS VCRs. Although this approach reduces the number of students included, it ensures an accurate measure of the effect of continued enrollment over time. The results for this subset of the full study sample should not be directly compared with other findings in this report. Figure 15 shows the results.

Figure 15: Learning Gains of Charter Students Compared to Gains for Average TPS VCRs by Students' Years of Enrollment in Charter Schools

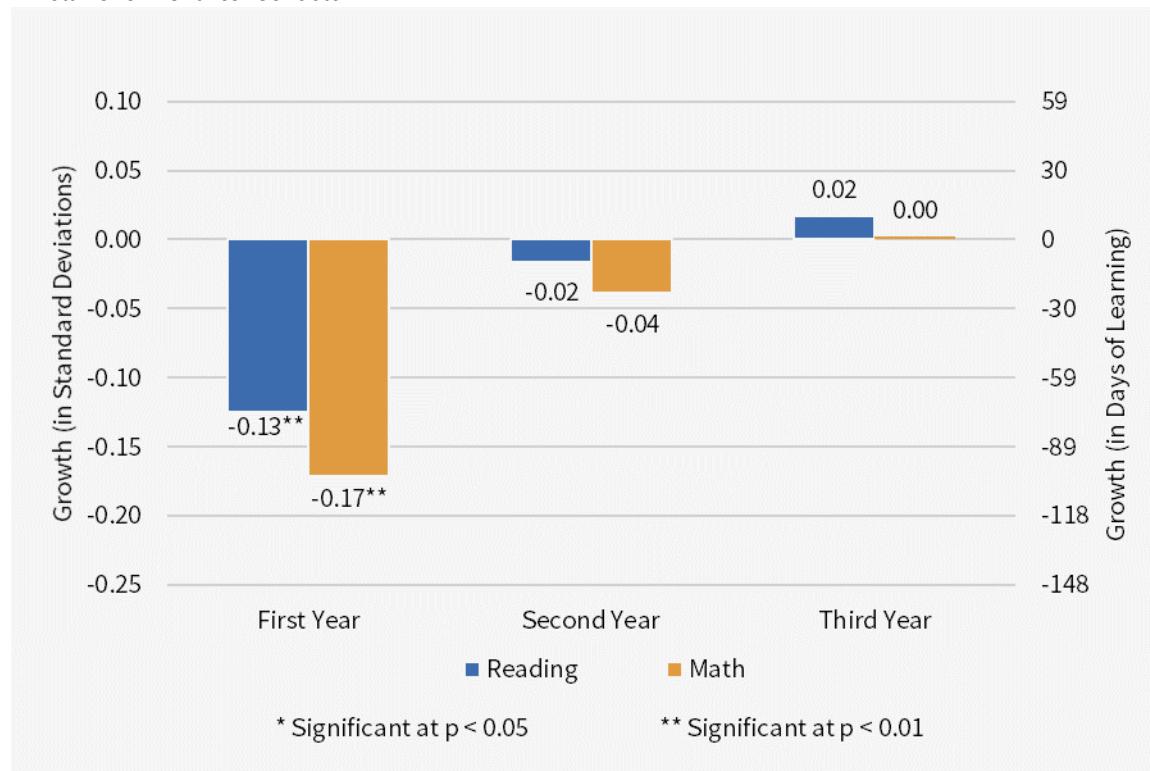


Figure 15 shows that students who are in their first year of charter school enrollment have significantly weaker growth compared to the average TPS VCRs. Students in their first year of charter school enrollment experience about 77 fewer days of learning in reading and about 100 fewer days of learning in math compared to the average TPS student. Students in their second or third year of charter school enrollment however perform similarly to the average TPS student in both subjects.

7. School-level Analysis

The numbers reported in the previous sections represent the typical learning gains at the student level across the state; they reveal what would be the likely result if a typical student enrolled in any of the Pennsylvania charter schools. The results pool all students in all schools in all growth periods. The prior results do not let us discern if some charter schools are better than others. Since school-level results are of interest to policy makers, parents and the general public, we aggregate charter student performance to the school level for each charter school in the state. This view is necessarily limited to charter schools with sufficient number of tested students to make a reliable inference on performance.

Comparative School-Level Quality

It is important to understand the counterfactual used in this section. As shown in Table 1 earlier in the report, the student populations within the typical charter school and their feeder schools differ, making whole-school to whole-school comparisons unhelpful. Here instead, we pool each school's VCRs to simulate the “apples to apples” TPS to serve as the control condition for testing the performance of charter schools. This simulated TPS reflects a precise estimate of the alternative local option for the students actually enrolled in each charter school.

To determine the range of charter school performance, we estimate the annual learning impact of each Pennsylvania charter school over the two most recent growth periods (2015-2016 and 2016-2017).¹⁹ The estimated learning impact for each charter school can be positive (statistically different from zero with a positive sign), negative (statistically different from zero with a negative sign), or zero. We use it to infer how the academic quality of a charter school compares to the quality of traditional public schools which students in that charter school would have potentially attended if they had not attended a charter school.

A statistically positive learning impact for a charter school suggests that the charter school has stronger learning growth than the alternative TPS options for its students. A statistically negative learning impact for a charter school implies the school makes less progress than the traditional schools its students would have attended. A zero learning impact means that the charter school and the TPS alternatives for its students have similar performance.

Our total sample consists of 155 schools with reading scores and 152 schools with math scores in the 2015-2016 and 2016-2017 growth periods.²⁰ Table 5 below shows the breakout of the performance for the included Pennsylvania charter schools.

¹⁹ We chose to include only the two most recent growth periods in this analysis in consideration of the dynamic growth within some charter schools and to provide the most contemporary picture of performance possible.

²⁰ As noted in Table 1, charter schools are smaller on average than their corresponding feeder schools.

Furthermore, some charter schools elect to open with a single grade and mature one grade at a time. Consequently, care is needed when making school-level comparisons to ensure that the number of tested students in a school is sufficient to provide a fair representation of the school's impact. Our criterion for inclusion is at least 60 matched charter student records over the two growth periods or at least 30 matched charter records for schools with only one growth period.

Table 5: Performance of Charter Schools Compared to Their TPS Alternatives in Pennsylvania

	Significantly Worse		Not Significantly Different		Significantly Better	
Subject	Number	Percent	Number	Percent	Number	Percent
Reading	35	23%	51	33%	69	45%
Math	48	32%	54	36%	50	33%

In reading, 45 percent of charter schools perform significantly better than the traditional schooling environments the charter students would have otherwise attended. In math, 33 percent perform significantly better than TPS alternatives. To benchmark these figures nationally, 25 percent of charter schools in the nation outperform their local counterparts in reading and 29 percent do so in math.²¹ At the other side of the distribution, 23 percent of Pennsylvania charter schools have significantly weaker reading results than their local TPS counterparts, and 32 percent do so in math. Comparing to the national picture, 19 percent of charter schools in the nation pale against the local TPS alternatives in reading and 31 percent do so in math. In reading, 33 percent of Pennsylvania charter schools have results that do not differ significantly from the local TPS option. In math, 36 percent of Pennsylvania charter schools have similar growth performance compared to the local TPS alternatives.

²¹ CREDO (2013). National Charter School Study 2013. <http://credo.stanford.edu>.

Growth and Achievement

The impacts of charter schools on academic growth relative to the local competition are informative for many questions, but they do not indicate how well students perform in absolute terms. Since many of the students served by charter schools start at low levels of achievement, the combination of absolute achievement and relative growth is vital to understanding their success.

For each school, the tested achievement of its students over the same two periods covered by the academic growth analysis (2015-2016 and 2016-2017) is averaged and transformed to a percentile within the statewide distribution of achievement.²² The 50th percentile indicates statewide average performance for all public school students (traditional and charter). A school achievement level above the 50th percentile indicates that the school's overall achievement exceeds the statewide average. We use the effect sizes discussed above to measure growth. We display each school's achievement and growth effect size in a two-dimensional plot, displayed in Tables 6 and 7.

Graphics Roadmap 3

Here is a note about how to interpret the results in Tables 6 and 7:

There are four quadrants in each table. We have expanded on the usual quadrant analysis by dividing each quadrant into four sections. The value in each box is the percentage of charter schools with the corresponding combination of growth and achievement. The value in the center of each quadrant is the sum of the four sections in that quadrant. These percentages are generated from the 2016 and 2017 growth periods.

The uppermost box on the left denotes the percentage of charters with very low average growth but high average achievement. The box in the bottom left corner depicts low-growth, low-achieving schools.

Similarly, the uppermost box on the right contains the percentage of charters with high average growth and high average achievement. The bottom right corner contains high-growth, low-achieving schools.

The major quadrants were delineated using national charter school data. We would expect the majority of schools to have an effect size between -0.15 and 0.15 standard deviations of growth (the two middle columns). Similarly, we would expect about 40 percent of schools to achieve between the 30th and 70th percentiles. These expectations are based on how we view a normal distribution with the majority of the sample falling within one standard deviation of the mean.

²² Average achievement was computed using students' z-scores from the end of the growth period (e.g., spring 2016 and spring 2017), and the resulting school-level mean was then converted into a percentile.

Table 6: School-Level Reading Growth and Achievement in Pennsylvania Charter Schools

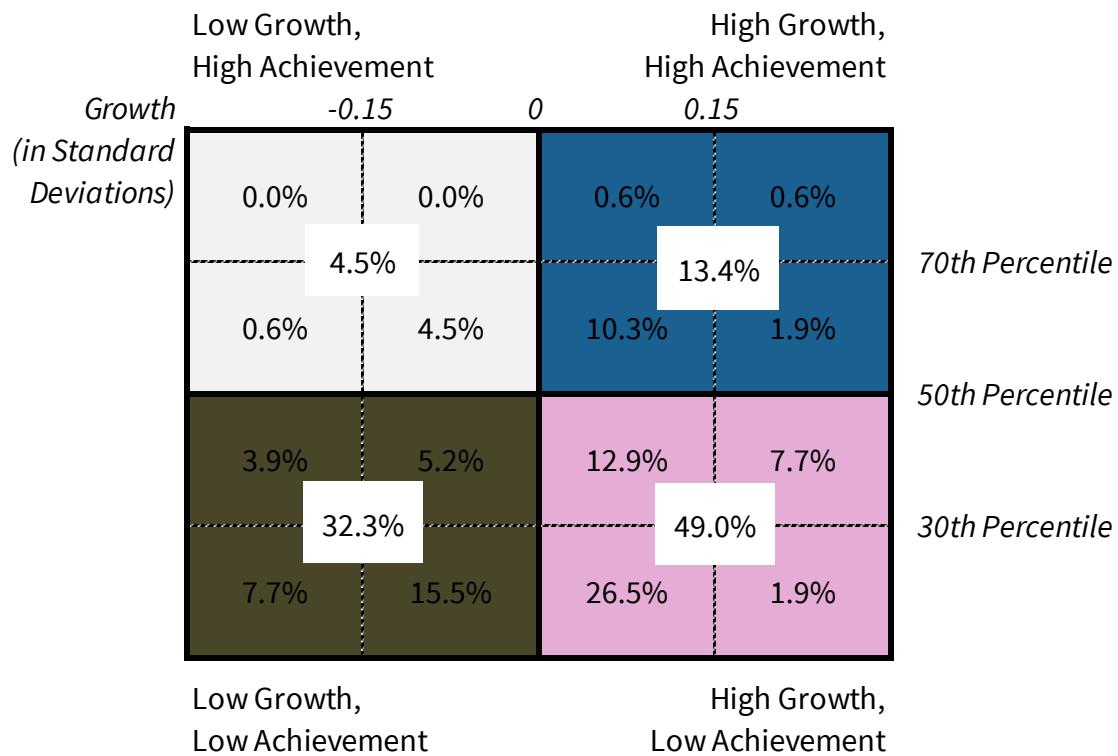
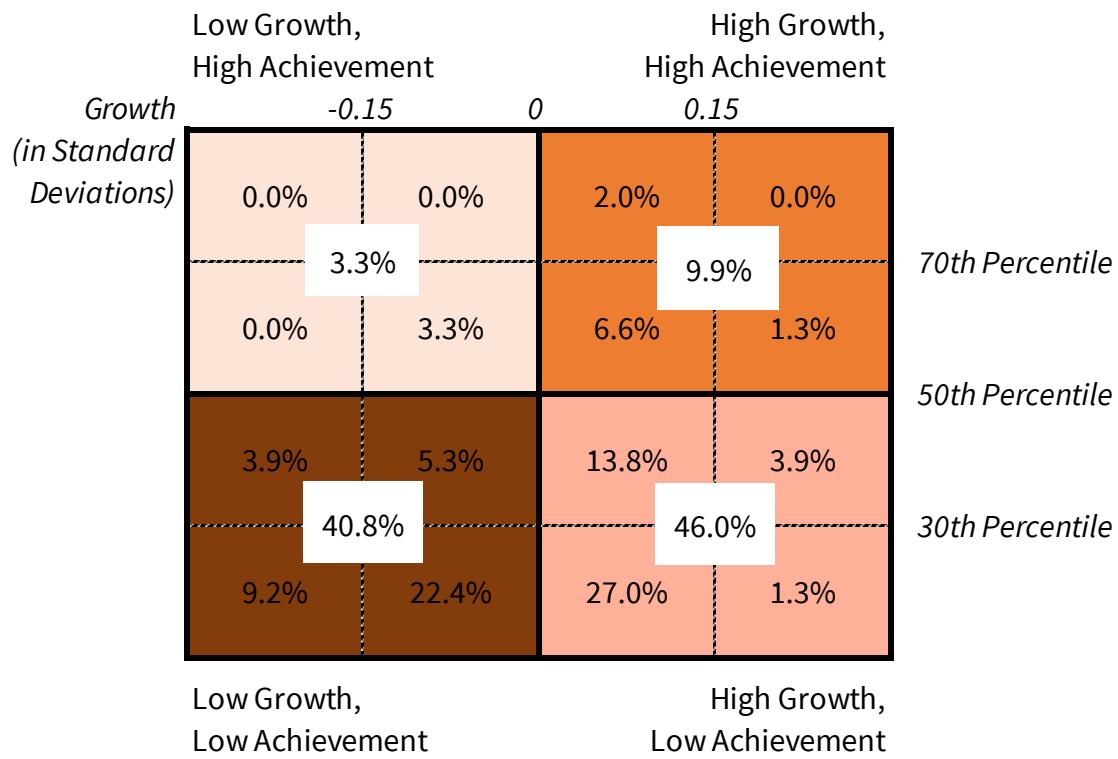


Table 6 shows the reading achievement and growth results for the Pennsylvania charter schools included in this analysis. In reading, 97 out of 155 Pennsylvania charter schools (62.4 percent) have positive average growth (this percentage is the sum of the eight squares in the blue and pink quadrants on the right half of the table). Only 13 percent of charters have positive growth and average achievement above the 50th percentile (i.e., the total for the blue quadrant on the top right). A total of 49 percent of charter schools in the pink box post above average reading growth, while posting below average achievement.

About 37 percent of schools post lower than average growth (the sum of gray and brown quadrants on the left half of the table). Approximately 81 percent of Pennsylvania charter schools perform below the 50th percentile in achievement (the sum of the brown and pink cells in the lower half of the table). The area of the greatest concern is the 32 percent of Pennsylvania charter schools that lie in the lower left quadrant in the table. These schools are characterized by both low achievement and low growth in reading.

Table 7: School-Level Math Growth and Achievement in Pennsylvania Charter Schools



In math, 85 of the 152 Pennsylvania charter schools (around 56 percent) have positive average growth in math, as seen in the combined orange and pink quadrants on the right half of Table 7. Just under 10 percent of Pennsylvania charter school exhibit stronger than average growth, and post achievement above the 50th percentile (the orange quadrant in the upper right of the table). Almost 87 percent of charter schools in Pennsylvania post below-average achievement (sum of the cells in the lower half of the table). As in the previous table, the schools of the greatest concern are those schools in the lower left (brown) quadrant that demonstrate both low achievement and low growth; they account for 77 schools (nearly 41 percent) of the charter schools in Pennsylvania.

8. Analysis of Online Charter Schools

Overall Charter Impact by Delivery System

Pennsylvania consists of both brick-and-mortar charter schools and online charter schools. Students from all over the state can attend online charter schools and receive instruction online. As Table 2 revealed, online charter schools enroll over 25 percent of charter students in Pennsylvania and have different student compositions compared to brick-and-mortar charters. CREDO's earlier study on online charter schools also found that online charter schools serve students with higher mobility rates and have significantly negative impacts on student academic progress.²³

In this section, we break down the charter school impact on student performance by delivery system. Figure 16 compares the performance of students in online charter schools and students in brick-and-mortar charters to the performance of the "average TPS VCR." This is followed by Figure 16a that displays the difference in learning of students enrolled in online charter schools compared to those who attend brick-and-mortar charters.

²³ Woodworth, J., Raymond, M., Chirbas, K., Gonzalez, M., Negassi, Y., Snow, W., VanDonge, C. Online Charter School Study (2015). <https://credo.stanford.edu/pdfs/Online%20Charter%20Study%20Final.pdf>.

Figure 16: Student Learning Gains for Students in Pennsylvania Online and Brick-and-Mortar Charter Schools Benchmarked against Learning Gains for Average TPS VCRs

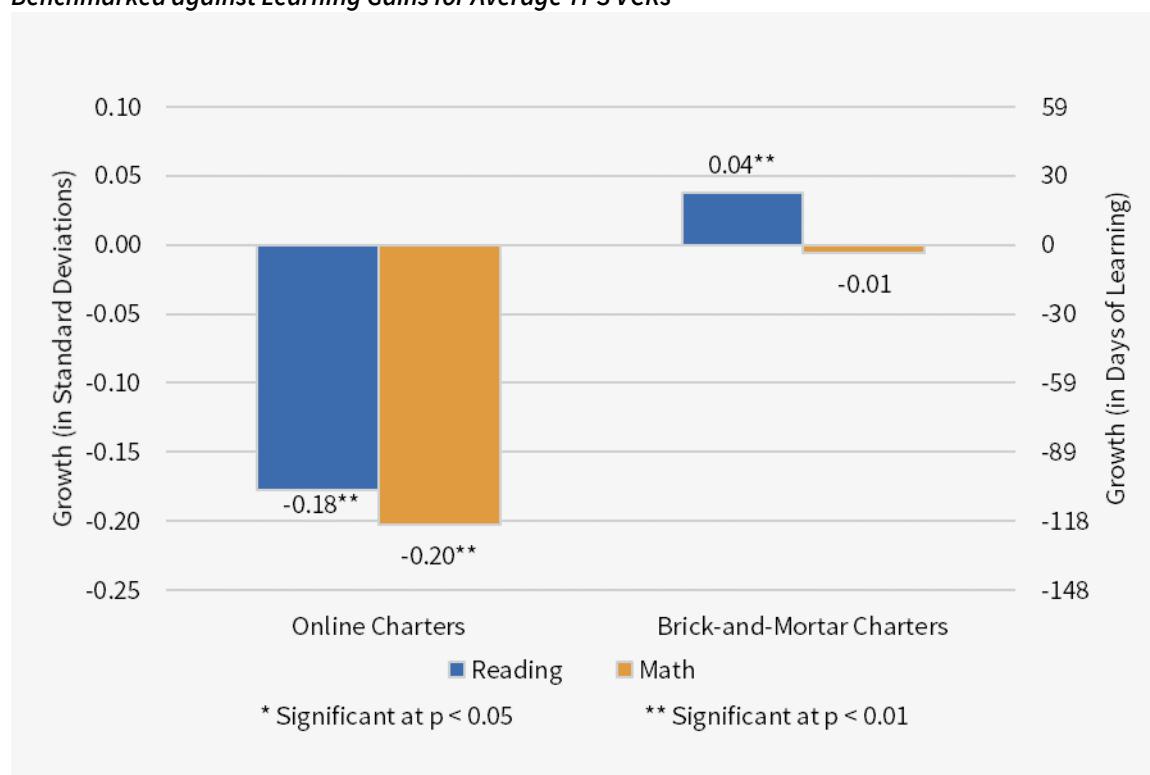
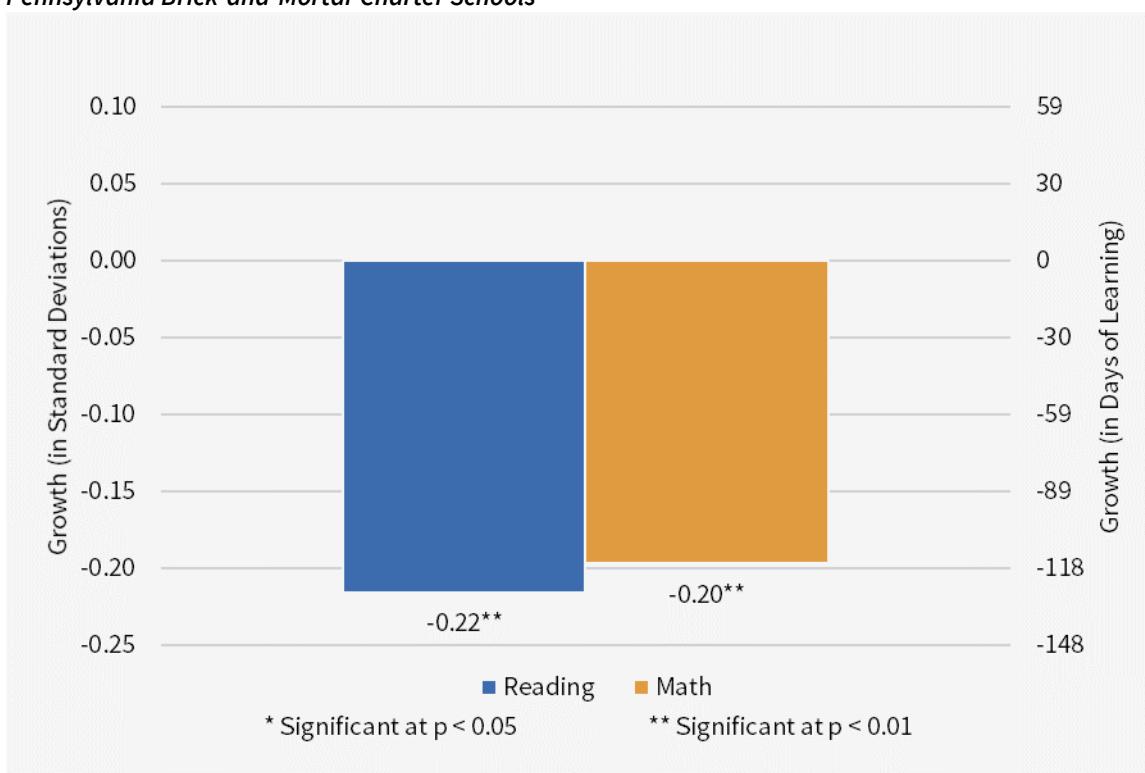


Figure 16 shows that students attending online charter schools have weaker growth in both reading and math compared to the average TPS VCR. These gaps translate to 106 fewer days of learning in reading and 118 fewer days of learning in math. Students attending brick-and-mortar charter schools however exhibit positive growth in reading compared to the average TPS VCR, gaining about 24 days of learning. In math, brick-and-mortar charter school students perform similarly to the average TPS VCR.

Figure 16a compares the performance of students attending online charter schools against that of students attending brick-and-mortar charter schools (whose baseline is represented by the 0.00 line). Online charter school students have significantly weaker growth in both subjects. Students attending online charter schools experience about the equivalent of 130 fewer days of learning in reading and about 118 fewer days of learning in math compared to students attending brick-and-mortar charter schools.

Figure 16a: Student Learning Gains in Pennsylvania Online Charter Schools Benchmarked against Students in Pennsylvania Brick-and-Mortar Charter Schools



Two important points arise from these graphics. First, Pennsylvania students in online charter schools have learning gains in both subjects that dramatically lag behind both the average TPS and brick-and-mortar charter school peers. Second, the negative overall charter impact on math progress in Figure 3 is driven by the strikingly negative math growth of students in online charter schools. The performance of the online schools depresses the overall sector performance despite serving only one quarter of charter school students in the state.

Online Charter School Impact for the 2014-2017 Cohort

This section compares the performances of Pennsylvania online charter schools across two of CREDO's studies: CREDO's 2015 Online Charter School Study and this current 2019 study on Pennsylvania charter schools. Figure 17 depicts the academic growth of Pennsylvania's online charter sector in the two reports. It is important to reiterate that the transformations of growth units of standard deviations into days of learning in this study is updated from past reports, using the most recent NAEP scores. Therefore, only growth in standard deviations is shown in Figure 17. In addition, as explained in the Study Approach chapter, we tweak our VCR method a little in this study by matching a charter student by period as to meet the WWC Version 4.0 requirement for baseline equivalence. Therefore, the comparison of the overall online charter school effect across these three reports is only suggestive.

Figure 17: Average Learning Gains in Pennsylvania Online Charter Schools Compared to Average Gains for TPS VCRs from the 2015 Online Study and 2019 Pennsylvania Study

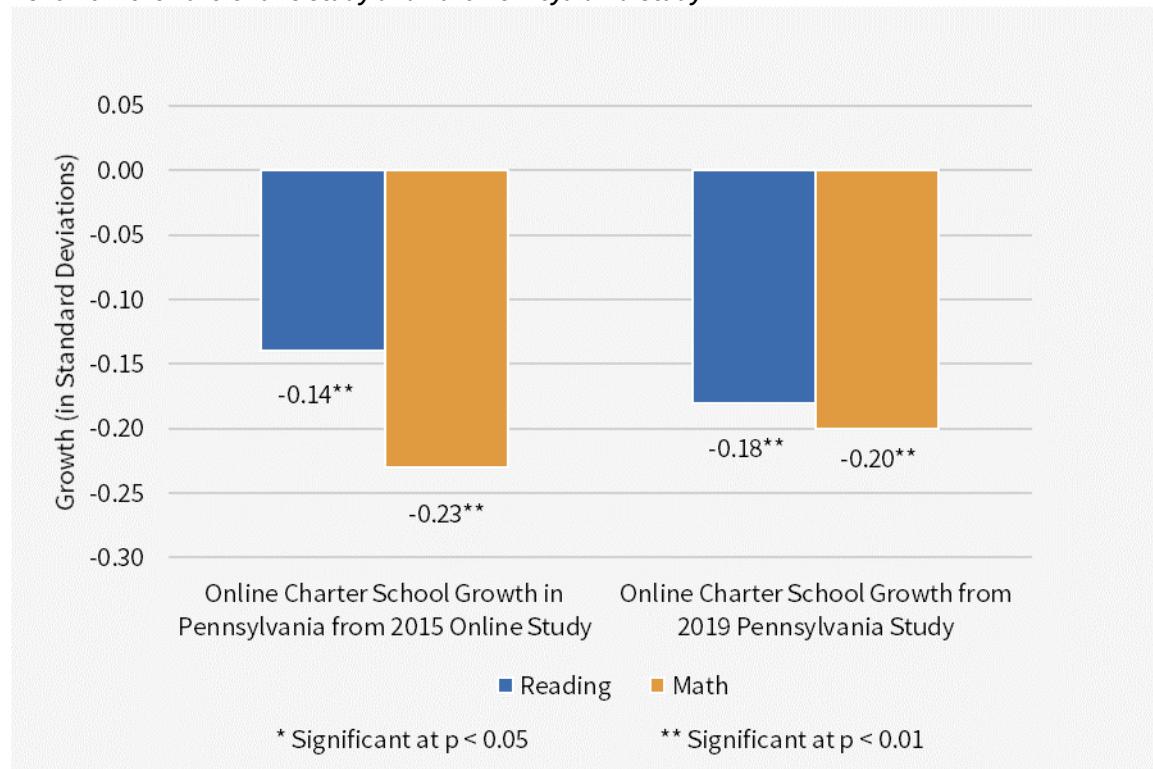


Figure 17 shows little change in the academic progress of Pennsylvania online charter school students across the studies. Online charter schools register weaker learning gains in both reading and math compared to the average TPS VCR across both studies. This study reveals a slightly larger reading gap between online charter school students and the average VCR compared to the 2015 Online Study. In math, the gaps have slightly shrunk. Overall, this graph shows no substantial academic improvement of Pennsylvania's online charter sector across these two studies.

Table 8 summarizes the effect that online and brick-and-mortar charter schools have on different student groups. The results represent the growth of each group relative to TPS VCRs in the same subgroup. The growth data for brick-and-mortar charters and online charters found in the rows labeled “Overall Impact” correspond to those in Figure 16.

Table 8: Learning Gains of Online and Brick-and-Mortar Charter School Student Subgroups Compared to Gains of TPS VCRs in the Same Subgroup

Student Group	Overall Charter	Brick-and-Mortar Charter	Online Charter
Reading			
Overall Impact	-0.02	0.04**	-0.18**
Special Education Students	-0.04*	0.01	-0.16**
Students in Poverty	0.01	0.05**	-0.16**
Black Students	0.04*	0.06**	-0.08**
Hispanic Students	0.02	0.05**	-0.12**
Math			
Overall Impact	-0.05**	-0.01	-0.20**
Special Education Students	-0.06**	-0.01	-0.17**
Students in Poverty	-0.03*	0.00	-0.19**
Black Students	0.02	-0.01	-0.11**
Hispanic Students	-0.03	0.00	-0.15**

In reading, the overall positive impact of brick-and-mortar charter schools in Pennsylvania holds for students in poverty, Black students, and Hispanic students. Students in brick-and-mortar charter schools with these characteristics gain up to 35 more days of learning in reading compared to TPS VCRs in the same subgroup. Students receiving special education services in brick-and-mortar charter schools perform similarly in reading compared to TPS VCRs in special education. In math, we observe similar performance of brick-and-mortar charter school special education students, students in poverty, Black students, and Hispanic students in comparison with TPS VCRs in the same subgroup. The overall negative impact of online charter schools relative to TPS VCRs is also found for special education students, students in poverty, Black students, and Hispanic students in both reading and math.

We can draw two main conclusions from Table 8. The first is that the disaggregation of the charter impact of subgroups into the two subsectors shows that online charter schools depress the charter effect for each of these subgroups. We can also conclude that the negative impact for online charter schools cannot be attributed to their demographic composition, since the negative impact is found across many subgroups.

9. Synthesis and Conclusions

Summary of Major Findings

This study examines the academic progress of students in Pennsylvania charter schools over a four-year period. Our data window ranges from the 2013-2014 school year to the 2016-2017 school year, used to create three year-to-year measures of progress, or “growth periods”. Table 9 presents a summary of the results from the various analyses in this report.

Table 9: Summary of Analysis Findings for Pennsylvania Charter School Students Benchmarked against Comparable TPS Students

	Reading	Math
Pennsylvania Charter Students	Similar	Negative
Students in Charters in 2014-2015	Similar	Negative
Students in Charters in 2015-2016	Similar	Negative
Students in Charters in 2016-2017	Similar	Similar
Students in Urban Charter Schools	Positive	Similar
Students in Suburban Charter Schools	Negative	Negative
Students in Town Charter Schools	Negative	Negative
Students in Rural Charter Schools	Similar	Negative
Students in Elementary Charter Schools	Positive	Similar
Students in Middle School Charter Schools	Similar	Similar
Students in High School Charter Schools	Similar	Similar
Students in Multi-level School Charter Schools	Similar	Negative
Black Charter School Students	Negative	Negative
Hispanic Charter School Students	Negative	Negative
Charter School Students in Poverty	Negative	Negative
Black Charter School Students in Poverty	Negative	Negative
Hispanic Charter School Students in Poverty	Negative	Negative
Special Education Charter School Students	Negative	Negative
English Language Learner Charter School Students	Negative	Negative
Students in First Year Enrolled in Charter School	Negative	Negative
Students in Second Year Enrolled in Charter School	Similar	Similar
Students in Third Year Enrolled in Charter School	Similar	Similar
Students in Online Charter Schools	Negative	Negative
Students in Brick-and-Mortar Charter Schools	Positive	Similar
Special Education Students in Online Charter Schools	Negative	Negative
Special Education Students in Brick-and-Mortar Charter Schools	Similar	Similar
Students in Poverty Attending Online Charter Schools	Negative	Negative
Students in Poverty Attending Brick-and-Mortar Charter Schools	Positive	Similar
Black Students in Online Charter Schools	Negative	Negative
Black Students in Brick-and-Mortar Charter Schools	Positive	Similar
Hispanic Students in Online Charter Schools	Negative	Negative
Hispanic Students in Brick-and-Mortar Charter Schools	Positive	Similar

Over the three growth periods in this study, the typical charter school student in Pennsylvania had similar academic growth in reading and weaker math growth compared to their TPS counterparts. In math, the learning difference is about the equivalent to losing 30 days of learning compared to their TPS peers. In the first two growth periods of the study, students in Pennsylvania charter schools experience growth similar to their TPS peers in reading, while experiencing weaker growth in math. By the third growth period, students in Pennsylvania charter schools exhibit similar growth to their TPS counterparts in both reading and math.

Beyond the overall findings, the analysis provides more nuanced insight into charter school performance in Pennsylvania. Students attending urban charter schools learn more than their TPS peers in reading while performing similarly in math. Students attending rural charter schools perform similarly to their TPS peers in reading while showing significantly weaker growth in math. Students attending charter schools in suburban or town settings have significantly weaker growth compared to their TPS peers in both subjects.

The analysis by school grade configuration shows that students in elementary school experience greater growth than their TPS peers in reading, while performing similarly to their TPS peers in math. Students in multi-level charter schools have significantly weaker growth in both reading and math compared to their peers in TPS. Students in charter middle schools or charter high schools have similar growth to their TPS peers in both reading and math.

Black students attending charter schools in Pennsylvania gain approximately 24 additional days of reading than their Black TPS peers, while having similar growth in math. Hispanic students attending Pennsylvania charter schools have similar growth to their Hispanic TPS peers in both reading and math. Charter school students in poverty post similar growth to their TPS peers in reading while posting significantly weaker growth to their TPS peers in math, translating to 18 fewer days of learning. However, Black students in poverty post significantly stronger reading growth than their Black TPS peers in poverty, with gains of approximately 35 additional days of learning, while having similar growth in math. Hispanic students in poverty also exhibit stronger growth in reading than their Hispanic TPS peers in poverty (approximately 24 additional days of learning), while posting similar growth in math.

Charter school students receiving special education services have significantly weaker growth than their TPS peers in both reading and math. These results are realized as 24 fewer days of learning in reading and 35 fewer days of learning in math. Charter school students with ELL designation perform similarly to their TPS peers with ELL designation in both reading and math.

We also find that on average, students in their first year of charter school enrollment post significantly weaker growth than their TPS peers, losing the equivalent of about 77 days of learning in reading and about 100 days of learning in math. Students in their second or third year of enrollment post similar growth to the TPS peers.

The section of our analysis regarding charter impact at the school level reveals that almost half of the charter schools in Pennsylvania outpace their local TPS counterparts in reading, while one third of charter schools outpace their local TPS counterparts in math. About one third of schools perform similarly to their TPS counterparts in both reading and math. Almost one quarter of schools underperform compared to the TPS counterparts in reading and one third underperform compared to the TPS counterparts in math.

Our school level analysis also reveals that 81 percent of Pennsylvania charter schools perform below the 50th percentile in reading achievement and almost 87 percent of Pennsylvania charter schools perform below the 50th percentile in math achievement. Locational decisions and the starting points of the students they serve influence these outcomes. In addition, 49 percent of all charter schools post lower-than-average achievement and above-average growth outcomes in reading, while 32 percent of charter schools post both below-average achievement and below-average growth. In math, 46 percent of charter schools post lower-than-average achievement with above-average growth, while almost 41 percent of charter schools post below-average achievement and below-average growth.

The debate over online charter schools is of particular interest in Pennsylvania. Our analysis reveals that students enrolled in Pennsylvania online charter schools post significantly weaker growth than the average TPS student and the average brick-and-mortar charter school student. Compared to the average TPS student, a student enrolled in an online charter school loses the equivalent of 106 days of learning in reading and about 118 days of learning in math. Students attending brick-and-mortar charter schools show significantly stronger growth in reading by 83 additional days of learning and similar growth in math compared to the average TPS VCR.

Our online school analysis also includes the disaggregation of results by special education status, poverty status, and race. The poor results for online charter school students are consistent across these student subgroups, so this effect is not being driven by student composition in online charter schools. It is also important to note that positive charter results in reading hold for students attending brick-and-mortar charter schools across many of the same subgroups. Students in poverty, Black students, and Hispanic students in brick-and-mortar charter schools all post stronger reading gains compared to the average TPS VCR. With this deeper analysis of online charter schools in Pennsylvania, we conclude that the poor performance of online charter schools is responsible for the overall low performance of the sector in the combined analyses.

Implications

Overall, there has been little to no progress in Pennsylvania charter school performance since CREDO's 2013 National Charter School Study.

Despite the generally flat performance overall, there are important positive findings for Pennsylvania charter schools. Most notable is the strong reading performance of brick-and-mortar set of charter schools. The impact on student academic growth from the brick-and-mortar charter subsector in Pennsylvania is on par with recognized strong charter sectors in other states such as Indiana, Illinois, or North Carolina. There are many schools that serve as strong examples in both reading and math performance that could provide valuable models for all Pennsylvania schools to emulate. Of special interest are the schools that show high growth and high achievement. Knowledge transfer and supported replication of these school models could rapidly increase the number of high quality seats in Pennsylvania.

At the same time, the evidence shows that Pennsylvania has substantial numbers of underperforming charter schools. To be clear, the proportion of sub-par charter schools has declined since our 2011 Pennsylvania study. However, with nearly one quarter of the schools lagging in reading and one third in math, the collective impact on student's academic careers and later life outcomes remains of deep concern.

This report found overwhelmingly negative results found from online charter schools; any potential benefits of online schooling such as student mobility and flexibility in curriculum are drowned out by the negative impacts on academic growth of students enrolled in such schools. Urgent attention of two forms is needed. First, education leaders must assess the experience of the specific students enrolled in the online schools to ascertain if their educational needs are being met in their current schools. Second, policy makers need to determine if current oversight policies or practices for online charter schools are sufficient to assure adequate performance.

Appendix A. Number of Observations for All Results

The numbers in the table below represent the number of charter observations associated with the corresponding results in the report. An equal number of VCRs were included in each analysis.

Appendix Table 1: Number of Observations for All Results

Student Group	Matched Charter Student Records	
	Reading	Math
Pennsylvania Charter Students Tested & Matched	122,735	123,759
Students in Charters in 2012-2013	38,581	40,682
Students in Charters in 2013-2014	38,628	39,347
Students in Charters in 2014-2015	45,526	43,730
Students in Urban Charter Schools	70,515	71,347
Students in Suburban Charter Schools	40,903	41,018
Students in Rural Charter Schools	9,113	9,194
Students in Town Charter Schools	2,204	2,200
Students in Elementary Charter Schools	40,234	40,408
Students in Middle School Charter Schools	8,900	9,033
Students in High School Charter Schools	1,499	1,458
Students in Multi-level School Charter Schools	72,102	72,860
Students in First Year Enrolled in Charter School	24,046	24,225
Students in Second Year Enrolled in Charter School	7,755	7,985
Students in Third Year Enrolled in Charter School	2,499	2,548
Black Charter School Students	57,117	57,846
Hispanic Charter School Students	19,189	19,656
White Charter School Students	40,140	40,074
Charter School Students in Poverty	86,289	87,374
Black Charter School Students in Poverty	48,934	49,604
Hispanic Charter School Students in Poverty	16,357	16,793
Special Education Charter School Students	19,376	20,062
English Language Learner Charter School Students	2,715	2,951
Grade Repeating Charter School Students	1,189	1,330
Online Charter School Students	30,059	30,334
Brick-and-Mortar Charter School Students	92,649	93,403
Special Education Students in Online Charter Schools	5,662	5,753
Special Education Students in Brick-and-Mortar Charter Schools	13,713	14,305
Students in Poverty Attending Online Charter Schools	14,866	15,046
Students in Poverty Attending Brick-and-Mortar Charter Schools	71,404	72,309
Black Students in Online Charter Schools	5,159	5,255
Black Students in Brick-and-Mortar Charter Schools	51,943	52,570
Hispanic Students in Online Charter Schools	2,383	2,437
Hispanic Students in Brick-and-Mortar Charter Schools	16,798	17,215

Appendix B. Technical Appendix

Match Rates for Pennsylvania Charter Students with Feeder List Restricted and Not Restricted

In the Study Approach chapter, we explain that the United States Department of Agriculture phased in the Community Eligibility Provision (CEP) in Pennsylvania and other states during the study period. The CEP allows schools and local education agencies with a minimum Identified Student Percentage (40 percent or more) to provide free breakfast and lunch to all students. To minimize over-identification of students living in poverty in the analysis, we drop from the list of feeder schools a very small number of TPS if their share of the students identified as economically disadvantaged by the state was 100 percent and represented a jump by 35 percentage points or more from the previous year. As Appendix Table 2 shows, restricting the feeder list did not affect the percentage of charter students for whom a VCR match was possible.

Appendix Table 2: Match Rates for Tested Charter School Student Observations in Pennsylvania with Feeder List Restricted and Not Restricted

	Reading	Math
Match Rate With Full Feeder List	84%	84%
Match Rate With Feeder List Restricted	84%	84%

Note: The feeder list with restriction does not include a very small number of TPS feeders whose share of economically disadvantaged students was 100 percent and represented a jump by 35 percentage points or more from the previous year.

Demographic Composition of Charter Students in the Study

This study examines the performance of students in charter schools who participated in annual accountability testing in Pennsylvania, occurring in grades 3-8 and in whatever grade the end-of-course (EOC) assessments were taken. The test scores allow us to use a common measure of performance across schools and over time. However, in each growth period of the study, students who are enrolled in non-tested grades are not included in the analysis of performance. This partially accounts for the differences in school and student counts in our analysis data compared to other published figures about the charter school population in Pennsylvania.

As discussed in the Study Approach chapter, we match tested charter students by period if they can be tracked for two or three periods in the study to conform to the new baseline equivalence requirement in the *Procedures Handbook Version 4.0* of What Works Clearinghouse. The following three tables present the student profiles of all and matched tested charter students in math in Pennsylvania in each matching period.

Appendix Table 3: Demographic Composition of Charter Students in the Study: Period 1

Student Group	All Charter Students Tested		Matched Charter Students	
	Number	Percent	Number	Percent
Pennsylvania Charter Students	86,416		72,441	
% Matched	84%			
Black Students	37,888	44%	32,155	44%
Hispanic Students	14,381	17%	11,397	16%
White Students	28,353	33%	25,203	35%
Students in Poverty	59,000	68%	49,771	69%
Special Education Students	15,389	18%	11,723	16%
English Language Learners	2,684	3%	1,762	2%
Grade Repeating Students	1,717	2%	771	1%

Appendix Table 4: Demographic Composition of Charter Students in the Study: Period 2

Student Group	All Charter Students Tested		Matched Charter Students	
	Number	Percent	Number	Percent
Pennsylvania Charter Students	41,894		35,377	
% Matched	84%			
Black Students	19,767	47%	17,579	50%
Hispanic Students	7,088	17%	5,642	16%
White Students	12,127	29%	10,465	30%
Students in Poverty	29,653	71%	25,785	73%
Special Education Students	7,461	18%	5,760	16%
English Language Learners	1,227	3%	826	2%
Grade Repeating Students	833	2%	405	1%

Appendix Table 5: Demographic Composition of Charter Students in the Study: Period 3

Student Group	All Charter Students Tested		Matched Charter Students	
	Number	Percent	Number	Percent
Pennsylvania Charter Students	18,893		15,947	
% Matched	84%			
Black Students	9,192	49%	8,091	51%
Hispanic Students	3,170	17%	2,613	16%
White Students	5,181	27%	4,410	28%
Students in Poverty	13,500	71%	11,799	74%
Special Education Students	3,387	18%	2,575	16%
English Language Learners	526	3%	363	2%
Grade Repeating Students	329	2%	151	1%

Comparison of Starting Scores of Matched Students and VCRs

The VCR method used in this study of Pennsylvania provided matches for 84 percent of tested charter students with growth scores in both reading and math. To assess the quality of the matches, we compare the starting scores of matched charter students and the Virtual Control Records obtained from the matches in both reading and math. The statistical tests of equality of means are shown in Appendix Figures 1 and 2 for math and reading, respectively. We find that the starting scores of matched students and the “virtual twins” used as point of comparison are almost identical. As matched students and their “virtual twins” have identical starting points in terms of learning in the beginning of a growth period, we can be confident that any difference in their final scores and therefore their learning growth can be attributed to charter school attendance, as the only observed way in which matched students and VCRs differ is that the former attend a charter school, while the latter consist of students attending a traditional public school.

Appendix Figure 1: Comparison of Starting Reading Scores of Matched Charter Students and VCRs

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]
Matched	122,702	-.4353565	.0025198	.8826718	-.4402954 -.4304177
VCR	122,702	-.4356375	.0025163	.8814316	-.4405694 -.4307056
combined	245,404	-.435497	.0017805	.8820501	-.4389868 -.4320072
diff		.0002809	.0035611		-.0066987 .0072606
		diff = mean(Matched) - mean(VCR)			t = 0.0789
Ho:	diff = 0				Welch's degrees of freedom = 245404
Ha: diff < 0					
	Pr(T < t) = 0.5314	Ha: diff != 0			
		Pr(T > t) = 0.9371			
					Ha: diff > 0
					Pr(T > t) = 0.4686

Appendix Figure 2: Comparison of Starting Math Scores of Matched Charter Students and VCRs

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]
Matched	123,735	-.508633	.0023221	.8168229	-.5131842 -.5040817
VCR	123,735	-.5089222	.0023186	.8156003	-.5134667 -.5043777
combined	247,470	-.5087776	.0016407	.8162102	-.5119934 -.5055618
diff		.0002893	.0032815		-.0061424 .0067209
		diff = mean(Matched) - mean(VCR)			t = 0.0881
Ho:	diff = 0				Welch's degrees of freedom = 247469
Ha: diff < 0					
	Pr(T < t) = 0.5351	Ha: diff != 0			
		Pr(T > t) = 0.9298			
					Ha: diff > 0
					Pr(T > t) = 0.4649

Measuring Academic Growth

With four years of data, each subject-grade-year group of scores has slightly different mid-point averages and distributions. For end-of-course assessments (EOCs) there are only subject-year groups because EOCs are not grade specific. This means a student takes this assessment after completing the course, no matter what grade she is in. In our study, scores for all these separate tests are transformed to a common scale. All test scores have been converted to standardized scores to fit a "bell curve", in order to allow for year-to-year computations of growth.²⁴

When scores are standardized, every student is placed relative to their peers in the entire state of Pennsylvania. A student scoring in the 50th percentile in Pennsylvania receives a standardized score of zero, while a standardized score of one would place a student in the 84th percentile. Students who maintain their relative place from year to year would have a growth score of zero, while students who make larger gains relative to their peers will have positive growth scores. Conversely, students who make smaller academic gains than their peers will have negative growth scores in that year.

Models for Analysis of the Charter School Impact

After constructing a VCR for each charter student, we then set out to develop a model capable of providing a fair measure of charter impact. The National Charter School Research Project provided a very useful guide to begin the process²⁵. First, it was useful to consider student growth rather than achievement. A growth measure provided a strong method to control for each student's educational history as well as the many observable differences between students that affect their academic achievement. The baseline model included controls for each student's grade, race, gender, poverty status, special education status, English Language Learner status, and whether he was held back the previous year. The literature on measuring educational interventions²⁶ found that the best estimation techniques must also include controls for baseline test scores. Each student's prior year test score is controlled for in our baseline model. Additional controls are also included for year and period (1st year in charter, 2nd year in charter, etc.). The study's baseline model is presented below.

$$\Delta A_{i,t} = \theta A_{i,t-1} + \beta X_{i,t} + \rho Y_t + \gamma C_{i,t} + \varepsilon_{i,t}$$

where the dependent variable is

$$\Delta A_{i,t} = A_{i,t} - A_{i,t-1} \quad (2)$$

²⁴ For each subject-grade-year set of scores, scores are centered around a standardized midpoint of zero, which corresponds to the actual average score of the test before transformation. Then each score of the original test is recast as a measure of variation around that new score of zero, so that scores that fall below the original average score are expressed as negative numbers and those that are larger receive positive values.

²⁵ Betts, J. and Hill, P. et al. (2006). "Key Issues in Studying Charter Schools and Achievement: A Review and Suggestions for National Guidelines." National Charter School Research Project White Paper Series, No. 2.

²⁶ Betts, J. and Tang, Y. (2011) "The Effect of Charter Schools on Student Achievement: A Meta-Analysis of the Literature." National Charter School Research Project.

And A_{it} is the state-by-test z-score for student i in period t ; A_{it-1} is the state-by-test z-score for student i in period $t - 1$; X_{it} is a set of control variables for student characteristics and period, Y_t is a year fixed effect, C is a vector of variables for whether student i attended a charter school and what type of charter school in period t , and ϵ is the error term. Errors are clustered around charters schools and their feeder patterns as well.

In addition to the baseline model above, we explored additional interactions beyond a simple binary to indicate charter enrollment. These included both “double” and “triple” interactions between the charter variable and student characteristics. For example, to identify the impact of charter schools on different racial groups, we estimate models that break the charter variable into “charter_black,” “charter_hispanic,” etc. To further break down the impact of charters by race and poverty, the variables above were split again. For example, black students in charter schools are split further into students who live in poverty (“charter_black_poverty”) and those that do not (“charter_black_nonpoverty”).

Presentation of Results

In this report, we present the impacts of attending charter schools in terms of standard deviations. The base measures for these outcomes are referred to in statistics as z-scores. A z-score of 0 indicates the student’s achievement is average for his or her grade. Positive values represent higher performance while negative values represent lower performance. Likewise, a positive effect size value means a student or group of students has improved relative to the students in the state taking the same exam. This remains true regardless of the absolute level of achievement for those students. As with the z-scores, a negative effect size means the students have on average lost ground compared to their peers.

It is important to remember that a school can have a positive effect size for its students (students are improving) but still have below-average achievement. Students with consistently positive effect sizes will eventually close the achievement gap if given enough time; however, such growth might take longer to close a particular gap than students spend in school.

While it is fair to compare two effect sizes relationally (i.e., 0.08 is twice 0.04), this must be done with care as to the size of the lower value. It would be misleading to state one group grew twice as much as another if the values were extremely small such as 0.0001 and 0.0002.

Finally, it is important to consider if an effect size is significant or not. In statistical models, values which are not statistically significant should be considered as no different from zero. Two effect sizes, one equal to .001 and the other equal to .01, would both be treated as no effect if neither were statistically significant.

To assist the reader in interpreting the meaning of effect sizes, we include an estimate of the average number of days of learning required to achieve a particular effect size. This estimate was calculated by Dr. Eric Hanushek and Dr. Margaret Raymond based on the latest (2017) 4th and 8th grade test scores from the National Assessment of Educational Progress (NAEP). Using a standard 180-day school year, each one standard deviation (s.d.) change in effect size was equivalent to 590 days of learning in this

study. The values in Table 3 are updated from past reports using more recent NAEP scores, which show slower absolute annual academic progress than earlier administrations.²⁷

In order to understand “days of learning,” consider a student whose academic achievement is at the 50th percentile in one grade and also at the 50th percentile in the following grade the next year. The progress from one year to the next equals the average learning gains for a student between the two grades. That growth is fixed as 180 days of effective learning based on the typical 180-day school year.

We then translate the standard deviations of growth from our models based on that 180-day average year of learning, so that students with positive effect sizes have additional growth beyond the expected 180 days of annual academic progress while those with negative effect sizes have fewer days of academic progress in that same 180-day period.

²⁷ Hanushek, Eric A. P.E. Peterson, & L. Woessmann (2012). Achievement Growth: International and U.S. State Trends in Student Performance. *Education Next*, Vol. 12, 1–35.